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EDITORIAL NOTES.

The Lighter Side at Liverpool.

THREE weeks from to-day, we are hoping to meet friends in Liverpool from all parts of the United Kingdom. Everything looks bright for a large concentration of representation of the gas industry at the famous seaport, and for a profitable and enjoyable meeting. We have already noticed the technical programme set for the occasion; and to-day, through the accident of fortunate contact last week with the President of the Institution (Mr. Edward Allen, M.Inst.C.E.), we are in a position to give in other columns an early outline of the engagements for the week—including those which will serve as the embroidery of the ones of primary importance to members. It is a compliment not alone to the Institution in its corporate capacity, but to the President (whose nature is of that appreciative order which will cause him to fully appraise the honour), that not only the Chairman, Mr. H. Wade Deacon, J.P., and the Directors of the Liverpool Gas Company are taking up whole-heartedly the *rôle* of hosts, but the Lord Mayor, Mr. H. R. Rathbone, and the members of the Corporation are joining with them in making the visit one of enjoyment and pleasant memory. Recognition of this will be marked by the members when his Lordship and the Chairman of the Gas Company accompany the President to welcome the visitors to the city on the opening morning of the meeting. The leaders of the City of Liverpool are anything but small minded. There may be contest in the parliamentary arena between a powerful civic body and a powerful company; but, with the issue, there is at once a settling-down in the most amicable manner to work, under the fresh circumstances, to the best advantage of the city. The Corporation recently met the Gas Company at Westminster over the new parliamentary proposals of the latter—including the calorific power standard; but a hint from the Committee enabled the two parties to shake hands on the very ground that had divided them, to arrange for the transfer to the Company of the Fazakerley Gas-Works that were the property of the Corporation, and the while to be mutually deciding upon the details for the reception of the Institution next month. They have done the work generously.

The first evening has been set apart for the reception of the visitors by the Chairman and Directors of the Gas Company at the Adelphi Hotel, on which occasion there will be dancing and music. The evening of the second day, the visitors are to be honoured by a reception by the Lord Mayor at the Town Hall. On Tuesday afternoon there will be a visit to the Linacre Gas-Works; and something will be arranged to occupy the ladies, of whom Mrs. Allen will take charge. There will be pleasant anticipations for Thursday afternoon and all day Friday. For Thursday afternoon, a steamship has been chartered for a trip on the river; and Friday will be devoted to an excursion to the historic City of Chester, where the visitors will be received by Mr. John Meadows Frost, who, as the Mayor of the city and Chairman of the Gas Company, will be able to receive the visitors both on behalf of the citizens and of the local gas interests. A sail up the river and a visit to Eaton Hall are among the items in what should be a very pleasurable day, if the weather is favourable. We trust sincerely that it will be so throughout the week, in order that the hospitality and the sights and pleasures of Liverpool may be thoroughly enjoyed, and the year's office of Mr. Allen may be fitly crowned. It has been a year full of calls on his time and energies. He has not spared himself—particularly through the National Gas Exhibition and Congress, at which he seemed to be in almost constant attendance, and to the success of which piece of industrial enterprise he contributed much by his presence and assistance. However, the President does not appear to have suffered one whit from his efforts and loyalty to the high position in which his professional colleagues placed him. These efforts and that loyalty will be duly acknowledged by the support of the members throughout the days of the approaching annual meeting.

A Carbonization Day at Manchester.

IT is customary for the members of the Manchester District Institution of Gas Engineers at their May meeting to get away from their central quarters, and visit the city or town in which their President renders service to the gas undertaking and to the public. Their President this year being the Chief Engineer of the Manchester Corporation Gas-Works (Mr. J. G. Newbigging), the Institution had perforce to stay at home; but there were no regrets over this, seeing that (apart from the friendly hospitality shown to them by Mr. Councillor Kay and his colleagues of the gas committee) the Manchester Gas-Works, more especially in modern times, are a never-failing source of interest, for there the history of technical progress in gas manufacture within the compass of the memory of many of us is to be read from actual illustrations in plant and method. No one can accuse Mr. Newbigging of not being technically progressive, nor of lacking professional ambition and foresight, nor of not being jealous of the good reputation through results of the works under his control. The address with which he inaugurated his year of office treated largely of the fundamental work of the gas manager—that is to say of the carbonization process, upon which and all ancillary to it, subject to markets, depends the net cost of gas into the holder. That is the cost upon which Mr. Newbigging is keeping a very critical watch, as, of course, upon it largely rests the price at which he can sell gas to the citizens; and we know that his ambition is that Manchester shall, if the Corporation will permit through not depriving the undertaking of its profits, have one of the lowest priced gas services in the country.

To inspect what the President is doing to attain this end was one of the objects of the visit to the Rochdale Road works on Saturday. At these works are examples of three stages of progress in carbonizing plant, method, and economy; and they illustrate how rapid has been transition from one state to another. In these busy times, one hardly realizes the rapidity of the changes till one deliberately thinks over them. It is really only a comparatively few years since that we were talking of the economy of the West compressed-air driven machines on both sides of the bench. There is illustration of this system at the Rochdale Road, with working costs—including labour from coal to the retorts to coke to the yard—amounting to 29·95d. per ton of coal carbonized, which is extravagant in these times for large works. Then there is illustration of a horizontal retort-house, with the combined charger-discharger of the Fiddes-Aldridge form, typical of the advance to a machine and coal-handling plant for discharging and charging on one side only of the bench, and the plant for coke removal on the other—the energy employed for driving being electricity. There we have the working costs brought down to 15·26d. per ton of coal carbonized. Then we pass on to the Glover-West vertical installation. Here we have a plant, of about 4 million cubic feet capacity, which supersedes a horizontal retort-house that occupied the same area, but was only capable of producing 2 to 2¼ million cubic feet of gas per day. This alone is a remarkable testimony to progress in economy; and as to the working costs, Mr. Newbigging, from experience at Droylsden with a trial installation on the same system, is confident that he is going with this new plant to cause them to recede below those with mono-operation by a combined stoking-machine. But there is this to be said, that in the second illustration the conditions are not the most favourable under which the combined machine would give, other circumstances being equal, the maximum economical account of itself, seeing that it has been applied to old retort-settings previously subjected to another method of working.

From carbonization in large works to carbonization in

small ones, attention was directed, in a paper at the meeting, by Mr. W. M. Carr, of Ormskirk. Mr. Carr had an excellent reception as a contributor to the proceedings of the Institution—this being the second *début* he has made this year under different circumstances; the former one being as a technical witness this session before Parliamentary Committees, when he created an excellent impression. With regard to the paper, Mr. Carr was faced with the problem of introducing economy into the Ormskirk Gas Company's works; and in considering this problem, there came in the inevitable tussle between capital charges and working economy—inevitable because of the necessity of clearly seeing, both in large and small gas-works, that the capital charges involved by new plant do not eat away more than the savings effected in working. But, incidentally, throughout the discussion of this point in the paper, we do not see that any mention was made of the collateral advantages claimed for certain systems; consideration being rigidly confined to direct carbonizing costs. Here, too, Mr. Carr is only considering the matter from the point of view of a relatively small works. He lays it down as an acceptable proposition (and no one will seriously dispute it) that power machinery may to-day be profitably applied to works carbonizing 5000 tons of coal per annum; and as in his works 6219 tons were carbonized in 1913, he is well above the ruling line.

But we clearly cannot adopt as a general principle the submission that "the principal factor governing the selec- "tion of carbonizing plant is capital cost, especially in the "case of small undertakings where the margin of saving is "necessarily small, and there is the danger of the interest "on the expenditure minimizing the benefit of such saving." The construction of the statement is not the best under the circumstances, as "minimizing the benefit" indicates that there is some benefit left, and what is left might, other considerations than those found in the paper being included, justify the expenditure. In any works it is the saving that can be effected which is the principal governing factor, as that, and that alone (excepting where expenditure is made for protection of interests) must determine whether the expenditure is financially justifiable. Mr. Carr shows this himself by his method of applying the test of possible saving to the capital expenditure which he estimates would be involved by the adoption of different types of carbonizing plant. He considers the relative costs of installing a horizontal retort plant with hand working; a horizontal plant with machine operation from one side of the bench (which was the system adopted); and a vertical retort installation —the three estimated capital expenditures being respectively £4500, £7500, and £10,000. The discussion by the author turns on the two latter figures. When originally considering the problem, he was satisfied (and has since been confirmed in his opinion) that the savings to be effected by expending £3000 more on the machine-worked horizontals than on the hand-worked ones would be remunerative; but there is no proof, but only assumption, that the spending of £2500 more on vertical retorts than on the machine-worked ones would not be profitable with an annual make of 80 millions. The actual capital expenditure on the plant put down was £7738; and the addition of a seventh bed of retorts will bring the expenditure up to £8238—making the maximum capacity per day 525,000 cubic feet, compared with the estimate of 500,000 cubic feet. There we have a variation in capital expenditure in the upward direction from the estimate.

Mr. Carr does not say upon which system of verticals he bases his estimates—whether intermittent or continuous; and this prevents a complete discussion of, or application of any reliable test to, the figures given in the tables in the paper. The costs are all estimated on the gas-producing capacity with the coal used, and gas of the high calorific value supplied at Ormskirk. With gas of 580-600 B.Th.U. gross, and the coal used, Mr. Carr does not allow a production higher than 12,000 cubic feet by the unnamed vertical retort system—the same as for horizontal working with power machinery. It is calculated in the paper that the verticals must show a saving of 7·2d. per ton of coal over the machine-worked horizontal installation. But when we come to examine the table of costs per 1000 cubic feet, it is found that the difference in the figures as presented against the vertical retort system is 0·51d. per 1000 cubic feet, multiplying which by twelve shows that the extra saving to be effected would be 6·12d. per ton, not 7·2d. Now let us examine the costs in the table. They are only estimates; and the two systems under comparison are accorded an equal make of 12,000 cubic feet per ton of coal carbonized. But in 1913, Mr. Carr produced, with his machine-worked horizontal installation, an average of 11,814 cubic feet, or 186 cubic feet per ton short of the 12,000 cubic feet. Multiplying this shortage by the 6219 tons of coal used in the year shows a loss in production on the estimates of 1,156,734 cubic feet. Is it not possible that there is a vertical retort system that would have given a make of 12,000 cubic feet or more, and have maintained a value of 600 B.Th.U. gross? We hold no brief for the one or the other system; but estimates have a bad habit of not always working out in practice, and this 6·12d. per ton—assuming the correctness of the capital figures in the paper—does not appear to be very far from reach. Anyway a claim can be made for a bit off the difference by reason of the lower make of gas.

Then it would be interesting to know whether, with the coal used, there is not a system of vertical retorts that would show a return of surplus coke for sale equal to that from a machine-worked horizontal retort installation. There is a low fuel claim for at least one of the vertical systems. It is also conceivable that the coke for sale from the horizontal system contains a larger percentage of moisture than the coke from a continuous vertical system; and that percentage has weight, and produces loss of calorific value. The difference in moisture should give an increased market value to the coke from the continuous verticals, while the density of the coke from intermittent verticals is not a negligible quality in assessing value. Mr. Carr assumes, too, that the values of the tar and ammoniacal liquor from the two systems are equal. This is a further point that some people will be inclined to dispute. Estimates of the kind in the paper are not of any considerable value; and an advocate of the vertical retort system would not have much difficulty in producing other figures which would show, on overall working and returns, that the difference of 0·51d. per 1000 cubic feet in costs is capable of being wiped-out by more complete and exact figures. However, it is a controversial matter. Mr. Carr follows in the footsteps of his father, in his advocacy of horizontal retort working, and is to be congratulated upon the manner in which his working results have justified his estimates for the plant he selected, using the Fiddes-Aldridge machine, and which results will be further financially improved when he comes to put in another bed of retorts, which will add to the difficulty of a vertical retort system, unless the quoted capital charges have meantime been reduced. We should like to hear what vertical retort firms have to say as to the capital estimates in the paper.

There are several other points of interest both in Mr. Carr's paper and in the description prepared by Mr. Newbigging of the Rochdale Road carbonizing plant. For instance, we see that Mr. Carr has installed his own electricity generating plant, while Mr. Newbigging takes his supply from the Corporation cables. Most gas engineers, on the score of reliability, prefer to have the generating plant under their own immediate care; but, of course, in a municipal works where the electricity supply is also under municipal control, price and expediency come in, though the risks of breakdown may be greater. Another point is that in his new vertical installation Mr. Newbigging has adopted the telpher system for coke removal; Mr. Carr with his new horizontal system uses coke tipping-waggons running on rails. The old types of coke-conveyor, we rather fancy, have largely had their day; and in the future for modern retort-houses the telpher or the coke-waggon running on rails will be more generally adopted, both for financial and coke protection reasons.

Works' Costs on Thermal Value.

In the paper by Mr. W. M. Carr noticed in the preceding article, there is a new suggestion regarding the figuring out of working costs. He says: "The net cost per 1000 cubic "feet is not always a comparable figure, as it does not allow "for varying qualities," which is admitted. But the author goes on to say: "It is possible, however, that, when the "calorific standard becomes general, and records by means "of accurate recording calorimeters are available, the re- "sults will be figured on the cost per million thermal "units." This is an interesting suggestion; and we should like the author to consider, and give us, the arguments in favour of the proposal. Until these arguments are heard, two or three off-hand considerations occur to us in opposition, though we would not for the moment put them down as

unanswerable or as irrevocable. *Primâ facie*, it seems to us that working results and costs must have relation to a definite quantity of raw material handled, and not to the product of an indefinite quantity; otherwise, we should have no fundamental basis as to the work done to produce the million thermal units. Therefore, there must be some factors behind the million thermal units to guide in making comparisons. With Mr. Carr's gas of 600 B.Th.U. per cubic foot, he would have 1666 cubic feet, or the product of about one-seventh of a ton of coal, representing the million B.Th.U.; while, if another company produce a gas of an average of 540 B.Th.U., their million B.Th.U. would be represented by 1852 cubic feet. Such differences point to the necessity of a fundamental and definite unit on which to base comparison; and this fundamental and definite unit must be based on raw material, in order to know whether working costs are really high or low. That is our first point. But we do agree with Mr. Carr that quality should be an essential factor in comparison. Therefore working costs should be expressed at per ton of coal, accompanied by yield in B.Th.U. That is our second point. But we shall never reach perfection in the matter, owing to the varying quality of coals; and this varying quality leaves us in the dark as to whether, for example, the working costs have been enhanced by the handling of a poor quality of coal or by indifferent working. The nearest point to which we can get (without including a cumbrous analysis) is to have both quality and quantity stated, with mention as to the source or sources of the coal, and, if "sources," the proportion in which the varieties of coal are used. Our final point is that working costs should also have direct relation to the unit of measurement on which the product is sold; and the unit of measurement for sales is the cubic foot. Therefore, in our opinion, working costs should be expressed on the quantity of raw material, supplemented at least by the quantity and quality of the primary product. To adopt Mr. Carr's suggestion would, we think, involve us in such nebulous conditions that comparison would be wholly valueless. However, we shall be glad to hear what he has to say in support of his original suggestion, and in opposition to our criticism.

The Muddled Electrical Calculators.

WHY is it when electrical advocates are required to make out a case for modern electrical methods against gas methods, they do not appear capable of doing so on fair and square lines? The question occurs to one after reading the report published in last week's issue of the inquiry held, on behalf of the Local Government Board, by Mr. T. C. Ekin, into the application by the Islington Board of Guardians for sanction to a loan of £3600 for the purpose of installing electricity in various institutions under their charge. The effect of the inquiry has been to bring before the Local Government Board, with greater emphasis than ever, the fact that municipal possession of a trading concern like electricity does not, through the identity and intimacy of the members of local governing bodies, result in judicial and businesslike administration, but rather in favoured patronage apart from all other considerations. In the matter of lighting, the interests of the electricity concern are paramount; the interests of the ratepayers are quite a secondary question; and those of users or occupants of the public institutions—are not thought worth consideration. The inquiry likewise brought before the Local Government Board a very singular muddle in connection with the electrical estimates for installing the electric light in the building; in connection with the easy-going calculations as to the amount of light required for the buildings concerned; and in connection with the loose manner of making comparative calculations respecting gas and electric lighting. The Gas Light and Coke Company deserve to be thanked for taking up this matter—not only because they are large ratepayers in Islington, and are at present the suppliers of the means of illumination in the public buildings in question, but because it was time effective exposure was made as to the processes by which the conversion of the lighting of such public buildings is accomplished, and as to the manner in which there is often an attempt to hoodwink the public, and incidentally the Local Government Board.

This Islington inquiry recalled, through the name of the Consulting Electrical Engineer—Mr. James Enright—being the same as that of the Consulting Electrical Engineer who advised the Hammersmith Guardians eight years or so ago, the investigation that was made in 1907 into the lighting of the Hammersmith Workhouse, when it was alleged that there had been installation on an elaborate scale, and when testimony was given that, notwithstanding, in various parts of the workhouse the light was inefficient. In this Islington case, we have something quite different. Elaborateness has been eschewed; and if Mr. Duncan Watson—an electrical contractor called for the purpose of giving a frank opinion of the estimates—is right, then everything has been cut-down to such a fine point that the initial expenditure has been underestimated, and the illumination allowance has been confined much to the same street. The Inspector indicated that he himself was impressed with the looseness in the bases of the calculations, which looseness appeared to be the distinctive feature of the scheme. On several points, Mr. Ekin was unable to obtain satisfaction. The Local Government Board from their side have a right to complain if they cannot obtain definite details from those put forward as experts to support a scheme of conversion, involving a few thousand pounds to execute, and an annual expenditure in excess of what would be occasioned to secure a much larger volume of illumination by means of modern incandescent gas-burners. The gas company whom it is sought to divest of the business have also from their side the right to know exactly the grounds on which the change is to be made, especially as they are interested both as sellers of an illuminating agent and as large ratepayers. But we must say that in this Islington inquiry the whole case presented in justification of the course proposed was one of the feeblest and most loosely knitted of any that has come before us.

It is amusing to read how the electricians called—Mr. Enright, Mr. Sutor, and Mr. A. H. Dykes—used the old electrical artifice of trying to show a low annual expense for electric lighting by employing small units and contrasting their cost with larger gas units. The ruse dies hard; and probably it will still be kept alive so long as there are Boards of Guardians and others who are, for the sake of an electricity undertaking, not unwilling victims of a practice that is not in our opinion quite in accord with professional and business ethics. It was at one time a common plan for electricians to compare the flat-flame gas-burner with the metallic filament electric-lamp. In this instance, we have the spectacle of professional men comparing the costs of 16, 24, and 32 candle power lamps, or 20, 30, and 40 watt lamps (which respective ratings are not confirmed by photometrical tests) with inverted gas-lamps consuming 4 to 6 cubic feet of gas, and giving from 80 to 120 (or thereabouts) candle power—excluding the pilot jets where used. The palpable foolishness of this does not appear to have any influence in deterring electrical experts from continuing to try to make a point from incomparables. They profess an ignorance (which sits clumsily upon them) of inverted gas-burner units of 20 and 25 candle power, rising upwards by easy gradations to 1000-candle power at low pressures, or from 60 to upwards of 4000 candle power at high pressures. Do Mr. Enright and Mr. Dykes mean to convey by their evidence that they had never heard of small inverted gas-burner units, till Mr. F. W. Goodenough gave at the inquiry evidence which is as concrete compared with their own readily crumbling testimony? When they come to compare like with like, as one would naturally do if one had an economical system to push forward for favour, they find that by gas an illuminating power enormously in excess of that furnished by electricity can be given for an equal expenditure, even though such favoured nation terms obtain as are proposed at Islington—2d. per unit and the free laying of cable, which appear to constitute an "undue "preference" (the current being used for both power and lighting). The electricians seem to have much to learn about relative values in quantity and quality of illumination for money expended, though perhaps for some special ornamental purposes they have facility of application on their side. To supplement their case in this inquiry, the experts spoke about gas-mantles not being able to withstand the draughts of corridors and such-like places—heedless of the fact that this is further testimony to inconclusive consideration, inasmuch as disproof is to be obtained by a mere lifting of the eyes, and observing the excellent lighting of some of our wind-swept bridges in London.

While electrical experts raise such puerile points, we would urge upon public authorities the importance of an assured constancy of illumination in such buildings as workhouses, hospitals, and infirmaries. Islington has given very pronounced illustration of the fact that electricity is not wholly dependable. There is also the point that in work-

houses, where human disability produced by age finds a home, lamps of high intrinsic brilliancy should not be employed without being properly shaded. Proper shading means additional cost of both installation and maintenance, and larger units consuming more energy than those allotted in the instance that suggested this article. The Islington Guardians, on considering all that transpired at this inquiry, cannot be happy over the proceedings, nor very proud of the case submitted to the Inspector in favour of electrical conversion. If this is the best case that could be made out for submission to the Local Government Board, then what must have been the character of the case upon which the Guardians themselves came to the conclusion to adopt electricity in preference to a more easily realized modern system of gas lighting? Moreover, what does the evidence disclose as to the competence of a majority of the Guardians for making on their own account an analytical investigation of this matter, and arriving at a determination as to the right course to pursue?

Financing the Del Monte Process.

Our surmise last week was right. The daily newspaper view of the Del Monte trial plant, and the publication of the reports by Mr. W. J. Atkinson Butterfield and Sir Boverton Redwood, were followed almost immediately by the prospectus of a new venture, the British Isles Oil Producers, Limited. Meantime, there is a strange silence as to what has become of Oil and Carbon Products, Limited, which was floated, or which there was an attempt to float, in April of last year, to run the Del Monte system, and as to the Del Monte Process Syndicate, Limited, which was registered some three months later. The Del Monte promoters—now that they have resolved that a smokeless solid fuel is a commercially dangerous fundamental product, and have made motor spirit and fuel oil their primary products and sulphate of ammonia their secondary one—have raised their ambitions, and have crowned the new venture with a nominal capital of a million sterling. This looks more substantial even on paper than £120,000; and it betokens on paper a wonderful future. Of the million pounds, £600,000 preference capital is to be held in reserve for purchases of shale-bearing territory, when the dormant wealth of the cannel on the Ballycastle Estate has been brought well on to the road to realization.

The present contemplated issue of capital is £400,000, 75 per cent. of which the public is asked to subscribe, and 25 per cent.—£25,000 in deferred and £75,000 in ordinary shares—is to be allotted as fully-paid to the vendors of property which the Company have agreed to acquire. The £300,000 offered to the public is all of the ordinary category. The £400,000 is the only part of the capital that has current importance; and in itself it constitutes a fairly liberal capital, on the figures disclosed (most of which were discussed in these columns last week) in the newspaper versions of the prospectus. The £100,000 earmarked for the vendors of property leaves £300,000. Out of this the promoters contemplate putting down a plant on the Ballycastle estate of a daily carbonizing capacity of 500 tons as suggested by Mr. Butterfield.

A 500-ton per day plant is certainly a big flight from the little trial plant with which the experimental work was carried out. However, Mr. Butterfield's estimate for the big plant was £185,000; so that there is still £115,000 of capital for which (if procured) there does not appear to be any immediate use, except in such part as may be required for contingencies and working capital. The nominal rate of dividend on the ordinary and deferred shares is 7 per cent.; and any balance of profit is to be equally divided (we take it so far as is thought advisable) between ordinary and deferred shareholders. Inasmuch as Mr. Butterfield calculated, with his 500-ton plant working at full blast for 360 days in the year, a profit of £112,894, the Company—*if* the estimates are fulfilled—would be able to pay a dividend three times the amount of the proposed nominal distribution, and then have £28,894 to place to reserve. Of course, this is not all going to be realized immediately; but the prospectus, with the reports and estimates of Mr. Butterfield and Sir Boverton Redwood as central features, is highly attractive, though highly speculative to those who are in a position to make examination of the prospects from all aspects—favourable and unfavourable. Certain it is that the Del Monte people, by their *coup de maître*, have been clever enough to leave—at any rate, for a period—the low-temperature carbonization processes out in the cold; seeing that their action must postpone the time when competing processes can hope to gain the moneyed confidence of the public.

Distribution Work.

High-pressure gas supply experiences are a never-failing source not only of interest, but instruction. Theoretical calculations as to what is right in such work are good up to a point, but they must be combined with practice and experience in order to ensure accuracy in requirement and permanence. The paper that Mr. B. F. Botwood read before the Midland Juniors last Saturday is a record of practical work; and it indicates how in the Birmingham Corporation gas distribution department work is conducted on a scientific and systematic basis. The paper is composite in cognate topics—dealing with the laying of 6 and 8 inch wrought-iron mains, with sockets of Stewarts and Lloyds' patent screw pattern, for high-pressure gas supply; with the laying of a 9-inch wrought-iron main, with long sleeve oxy-acetylene welded joints, for the reinforcement of the supply in one district; and with low-pressure castings standardization. Throughout the description are scattered studied hints as to what is necessary for the production of good work; and therein lies the chief value of the paper. In the high-pressure line, we are, by such work as has been done in Birmingham and elsewhere, settling down to a correct knowledge of what is needed to secure a tight job, to ensure longevity, to obtain proper control, to realize absolute safety, and to enable periodical inspection of vital parts—all important considerations.

Joints and Welding.

The paper is so packed with points that it is difficult in a few lines to call special attention to any of them. But the clip service attachment which is described and illustrated appeals to us as a strong and efficient device. The variety of pipe-joints used by the department is also an evidence that Birmingham at all events has not had the dire experiences which some of our high-pressure friends report with certain joints. The safety test described, of a socket joint with lead wool backed with yarn, is a good defence of that type of joint. But speaking of joints generally, and not particularly of this form, violent tests of the kind are not the same thing as the conditions to which joints are exposed in everyday subterranean life in roadways, where they are subject to vibration and sudden and variable stresses, and at differing temperatures. We know what can be done in loosening many a tight connection by prolonged and gentle motion. Mr. Botwood also makes a point of the care necessary in welding joints. This is not work that anyone should be put on without proper training; and, so much so is this recognized, that the acetylene people—if not in this country at least in one place abroad—have established special shops for the training of men in oxy-acetylene welding. In the promotion of economy in the distribution department, what Mr. Botwood has to say about the standardization of low-pressure castings is worth reading—and practising.

Photometrical Nomenclature and Units.

There was a valuable discussion at the meeting of the Illuminating Engineering Society last Thursday evening, introduced by Mr. A. P. Trotter, on the subject of the nomenclature and definition of photometric magnitudes and units. Several men whose names have high place through the work they have done in advancing the science of illumination contributed to the discussion; and, though to practical men there may be something repellent about the title of the paper, we can assure them that they will have their interest heightened as they read the paper and the report of the debate. The study of the science of illumination has of recent years largely extended our photometric vocabulary; and some of the expressions and units do not always appear to be used in a single or common sense. The time is therefore ripe, before there is an ageing of expressions and a growth of confusion as to meanings, to produce something like co-ordination. As Mr. Trotter shows, there is a tendency to get away from simple nomenclature and units, and to dress the science up in sombre and ambiguous terms. He seeks to put the brake on this tendency; and his paper is a plea for simplification, so that all—the practical man as well as the scientist—interested in illumination

may be attracted to, and not repelled from, the work of its scientific advancement.

The "Candle" as Primary Unit.

There are some ultraists in this matter who would jettison the "candle" as a photometric unit, and the term "candle power." But there is danger in this. It is a well known and usable unit; and if the layman cannot precisely define the standard candle, and the value obtained from it, he knows by experience that the use of the descriptive term and the application of a number secures for him about what he wants when he is out purchasing lamps. The electrical industry is trying to get away from the candle in the sale of incandescent electric lamps, by speaking of them as so many watt lamps, with the result that householders have no clear notion as to the illumination they will secure, not knowing anything about efficiencies per watt. It is a deceptive practice; but it affords concealment for the variable candle powers of like-rated incandescent electric lamps. With Mr. Trotter, Professor Silvanus Thompson, and others, we see no valid reason for throwing overboard the candle as the fundamental unit, seeing that it has obtained general use in this and other countries, and has its value strictly defined in relation to the units of other countries. It would check progress to supplant it, and cause confusion. While there may be much in favour of extending photometric units, nomenclature, and definitions for scientific use, the closer all this can be kept to what the ordinary practical man needs to acquire knowledge of the science of illumination, the better. We like to occasionally think over the words "applied science;" they help to keep in mind the necessity for a clear road being maintained between science and practice.

PERSONAL.

Many "happy returns" to the President of the Institution. Mr. EDWARD ALLEN celebrated his 64th birthday last Friday.

The Birmingham City Council have confirmed the appointment of Mr. RUPERT J. ROGERS as Assistant Fittings Superintendent to the Gas Department, and of Mr. E. H. W. COOKE as Accountant.

Mr. JOHN BRABBS, Assistant-Manager of the Selby District Council Gas-Works, has received the appointment of Manager of the Bollington (near Macclesfield) Gas-Works, out of nearly 100 applicants.

OBITUARY.

Alderman WILLIAM ANDREWS, of Coventry, died on the 14th inst., in his eightieth year, after a few days' illness. He entered the City Council in 1877, but had persistently declined to accept the Mayoralty. The coal seams of Warwickshire and the water-bearing strata of the district were his favourite studies. The Birmingham Corporation retained him as a witness in connection with their Elan Valley water scheme before the Parliamentary Committee; but ere Alderman Andrews could be called, the Committee intimated that the preamble of the Bill had been proved. The deceased first drew attention to the Shustoke reservoir water as a means of supplying Coventry with extra water; and the scheme has, within the last few years, been embodied in agreements that have been concluded between the Birmingham and Coventry Corporations.

The number of the "American Gaslight Journal" for the 11th inst. contains the announcement of the loss by death of one of the Editors—Mr. THOMAS JOHN CUNNINGHAM—which took place on the 6th inst., after a brief illness, at his residence in Brooklyn, where he was born in 1853. On leaving school he commenced work as a compositor in a printing establishment; and in May, 1870, he left the office of the "New York World" to fill the position of a printer upon our American contemporary. By his ability he advanced rapidly, and eventually obtained the position of Editorial Assistant to Mr. Joseph Russell Thomas on Jan. 7, 1889, when the "Journal" appeared for the first time as a weekly publication. On the death of Mr. Thomas towards the close of 1896, Mr. Cunningham became Senior Editor; and held the position till the last. In May, 1903, he was elected an honorary member of the Western Gas Association; and he was known personally to most of the members of the American Gas Associations. He had a genial nature, and gained the attachment of a large number of friends. He is survived by two unmarried sisters, with whom we sincerely sympathize in the loss they have sustained.

Whitsuntide Holiday.

In consequence of the Whitsuntide Holiday, the next issue of the "JOURNAL" will be published on WEDNESDAY, JUNE 3.

THE INSTITUTION MEETING AT LIVERPOOL.

The Programme in Outline.

HAPPENING across the President of the Institution of Gas Engineers (Mr. Edward Allen, M.Inst.C.E.) in London last week, he kindly supplied us with the following outline of the arrangements for the meeting of the members in Liverpool from June 16 to 19.

TUESDAY, JUNE 16.

10 a.m.	Reception by the Lord Mayor (Mr. H. R. Rathbone) and the Chairman of the Liverpool Gas Company (Mr. H. Wade Deacon, J.P.). President's Address, Reading of Reports, &c.
1.30 p.m.	The President and Mrs. Allen will entertain the members of the Council, readers of papers, and distinguished visitors to luncheon at the Adelphi Hotel. The Linacre Gas-Works will be open to inspection during the afternoon.
8 p.m.	A reception of members and their ladies by the Chairman and Directors of the Liverpool Gas Company at the Adelphi Hotel—Dancing and Music.

WEDNESDAY, JUNE 17.

10 a.m.	Lecture by Mr. Charles Carpenter, D.Sc., Reading and Discussion of Papers, &c.
1.30 p.m.	The Council will entertain the President at lunch.
8 p.m.	Reception by the Lord Mayor at the Town Hall.

THURSDAY, JUNE 18.

10 a.m.	Reading and Discussion of Papers to be resumed, Election of President and Office-Bearers for 1915, and other Business.
3.30 p.m.	Members will meet at the Liverpool Landing-Stage, and board the S.S. *Flying Kestrel*, for a sail on the River. If the weather is fine, the trip will extend to the Channel; if stormy, it will be confined to the River. Probably the Manchester Ship Canal will be visited.

FRIDAY, JUNE 19.

10 a.m.	Special train to Chester from Lime Street Station. Inspection of the Cathedral, City Walls, &c.
12.15 p.m.	Reception by the Mayor of Chester, who is also the Chairman of the Gas Company (Mr. John Meadows Frost). Luncheon at the Town Hall. Afterwards the members will sail up the River Dee to Eaton Hall. Permission has been generously extended to them to visit the House, Gardens, and Stables.
5 p.m.	Tea at Eccleston Ferry; subsequently returning by special train to Liverpool.

NOTES FROM WESTMINSTER.

ONLY a few points of interest call for notice this week. Things just now are more lively in the House of Commons itself than in the Committee rooms. But the appearance of Gas Bills has begun in the Second House; so that, as in connection with the Ashington Bill this week, there may be a few pickings of interest to be made from continued opposition. The London County Council Bill (which has only been before the Local Legislation Committee in connection with the celluloid clauses, owing to similar provisions appearing in another Bill) is still low down in the list; so that the proposal for high-pressure meter legislation is not likely to be discussed yet. When it is, there will be participation by representatives of the gas industry.

Electrical Fright.

Parliament has said that the benighted inhabitants of Ashington may be relieved from the yoke and insecurity of electricity supply, and have the freedom of choice between electricity supplied by the Newcastle-upon-Tyne Electric Company and gas to be furnished by the District Council, under a scheme for which Mr. Arthur Valon is responsible. Why Ashington should stand isolated from the communities of the British Isles in the matter of being in a position to exercise the liberty to place where they please their patronage in respect of the agents for lighting, cooking, and heating, is not clear. But we have this fact projecting from the parliamentary proceedings on the District Council Bill, that the electricity suppliers are absolutely frightened over the coming supply of gas, although they start off with the advantage of 3929 houses out of 5563 inhabited ones in the area already wired for electricity supply. The Coal Company, who are the backers of the electricity suppliers in the area (under the circumstances described when the Bill was in the House of Commons), were the opponents of the Bill as ratepayers; but the Newcastle-upon-Tyne Electric Supply Company were extraordinarily visible throughout the proceedings. Their representatives, however, were not able to satisfactorily explain why, though Parliament had

allowed electricity to go in and compete with gas in almost every other populous district in the country, gas should not under proper administration be permitted to go in and compete with electricity in the case of Ashington. What gave the electricity suppliers such a shock was that, notwithstanding that there are so many of the miners' houses wired, it was shown in the House of Commons that a very large proportion of the residents in the district were desirous of taking, and ready to take, a supply of gas as soon as the Council could give it them. Following this, in order to make assurance doubly sure, the Council, between the Commons and Lords stages of their measure, had another canvas made, and no less than 4235 householders have reiterated their wish to have a gas supply, and that out of the total of 5563 inhabited houses! The effect has been a startling one. The Electricity Company have almost gone down on hands and knees begging that this competition may be strangled. They have, in their agitation, offered to reduce the price of electricity to 3¾d. per unit (the price charged in Newcastle), give free lamps to the consumers, free wiring to additional houses, knock £500 off the quotation made for improved public electric lighting, and pay the costs of the promotion of the Council's Bill. All they want in return is the dropping of the gas scheme. Has there ever been seen a more distressing sight of fright than this on the part of an Electric Supply Company? Steadily, in face of it all, the Council have kept on with their Bill, and Parliament has finally said that the Ashington people may have a proper gas supply as they desire. Even after this, the opponents on clauses tried to throttle the scheme, by making it obligatory on the part of the Council to get the house owners' consents, and not those only of the tenants, to the putting in of gas pipes and fittings where electric wiring already exists. We have no doubt the Coal Company are considerable owners of miners' houses. We do not question, too, that their consent would be difficult to get. Mr. Lees, the Parliamentary Agent for the Bill, made a fine resistance to the application for the insertion of the business throttling clause; and the Committee were with him. They also refused other proposals interestedly made for the close anchoring of the new undertaking, which would have acted destructively upon the giving of its best services to the community.

Miners and Gas Cooking. A very interesting feature of this contest was the testimony given as to the preference that miners' households show for the conveniences of gas for culinary purposes rather than the solid fuel which the miners themselves produce. Mr. Valon, in his estimates, took quite a modest view of the likely consumption per house. There is greater prudence in this than in making computations which may encourage hopes that are not likely to be realized for some time. There was quite a mass of confirmation from actual experience as to the estimates erring on the right side, and as to the preference for gas on the part of miners. Mr. E. H. Stevenson quoted cases in mining districts in Wales where 68 and 65 per cent. of the gas consumers use cookers. Mr. Frank Jones has also experience of districts where the gas-ring and gas-cooker have preference over coal, solely on account of their convenience. Mr. William Cash, as Secretary of the Houghton-le-Spring Gas Company, testified to the fact that the miners in that district are very keen on taking gas through slot meters for both cooking and heating. The promoters got near home when they called Mr. A. C. Fawcett, the Secretary of the Blyth and Cowpen Gas Company, who showed that in his district—also a mining one—some 6500 houses out of 7123 are supplied with gas, though his Company have to meet the competition of the Northern Counties Electricity Supply Company, who were the predecessrs in Ashington of the Newcastle Electric Supply Company. Mr. R. Crawford, the Chairman of the Morpeth Gas Company, had a similar tale to tell. If miners are so keen on the conveniences of gas for cooking purposes, instead of on the inconveniences of the fuel they themselves raise from the earth—notwithstanding that in some cases, as in Ashington, they get a free supply of the latter—small wonder that gas has grown so popular for cooking and heating in districts far away from the coal-fields.

Sheffield and the Derwent Valley Works. The Sheffield Corporation came to Parliament on an errand over which they could hardly have hoped to succeed. It is really a simple matter, though it means to the city a great capital expenditure, and payment of a large annual interest, from which money they assert they will not reap the slightest benefit. The matter arises in this way: The Derwent Valley Water-Works Act of 1899 brought Sheffield, Nottingham, Derby, and Leicester into partnership over their great scheme. According to Sheffield, under the terms of the agreement between the partners, they were to pay jointly (in their statutory proportions) for works from which they in common would benefit; but in respect of works requisite for one particular place, and not for another, the place solely benefiting was to pay. There is a considerable length of aqueduct and other works from which Sheffield claim that they will derive no advantage; and therefore they have no desire to contribute to these particular works. A Committee of the Water Board decided that the constituent authorities should pay for all works in proportion to their statutory rights. They came to this decision under clause 85 of the Act of 1899. Sheffield's opposition to this ruling resulted in an arbitration, in which the Arbitrator was against Sheffield. The Corporation thereupon appealed to the Courts against the Arbitrator's award; arguing that the clause in question had not been properly construed by him. The Court held that it had been. This session the Corporation came to Parliament, and asked in a Bill that what they claimed was the intention and understanding of the parties in 1899 should be carried through by the amendment of the clause—their position now being that, in view of the construction placed upon it by the Arbitrator and the Courts, there had been a mistake in drafting the clause in 1899. Nottingham, Derby, Leicester, and the Derwent Board appeared in opposition; the front rank of the Parliamentary Bar were engaged; and Mr. Middebrook and his colleagues of the Local Legislation Committee sat for days listening to evidence and pondering over the matter. In the result, they also pronounced the clause to be good as passed in 1899. Sheffield has fired its last shot over this matter. It has to pay its share for works from which it will not derive any advantage. But who is responsible for passing a clause that Sheffield contends does not carry out the understanding of 1899? And how is it some one at Sheffield has not detected its alleged defect before this?

Hospital Provision. We lately had something to say about the request of the National Insurance Commissioners that the model clause referring to hospital accommodation in connection with new water-works construction, should be inserted in the Abertillery and District Water Board Bill. The Committee, it will be remembered, were informed of an ample provision having been made by the Board. This information was given by Mr. Baldwin Latham; and both the Committee and Mr. Lees, the Agent for the Bill, were thereby misled. As a matter of fact, the hospital accommodation has only been partially constructed; and the error arose through inadvertence in Mr. Latham's office in copying a document. The result of the mistake was that the Bill was recommitted to the Committee on unopposed measures. Mr. Lees explained the position; and Mr. Latham apologized for the error. The Chairman magnanimously exonerated all who had had any part in the mistake from any wilful intention of misleading the Committee. The model clause was inserted; and no one is a penny the worse for what occurred, though it would have been better if the Committee and the Parliamentary Agent had not been placed in a false position through a clerical blunder.

ELECTRICITY SUPPLY MEMORANDA.

THE writers in the electrical papers have been expending some of their time, space, and ink in urging the electricity supply industry not to be down-hearted over the Long Eaton judgment, but to take it that it really does very little in

Undue Preference. altering the position. Differential prices may, of course, continue, both for power and for lighting under those proper circumstances that justify a difference in price. Still, the electrical papers all seem to entertain some hope that the District Council will appeal against the considered judgment of Mr. Justice Sargant, which shows that they are not satisfied with the dictum as to what are similar circumstances, and as to what is undue preference. They would rather that the electricity supply industry should have all the rope they can get. They really want too much. While there is the expression of hope that the Council will again fight, there is nearly perfect harmony among our contemporaries (to use the words of one of them) that "the attempt to penalize a power consumer because he does not choose to employ electricity exclusively for lighting is not good business." They are queer customers some of these electrical contemporaries of ours. They with one hand urge the District Council forward to appeal against their discredited action; and with the other hand slap the faces of the members for having acted so foolishly as they did. There is no doubt about it, the Council have, by their ill-considered penalizing differentiation done a disservice to the electricity supply industry, as it has given not only publicity to the matter, but has secured a judicial ruling that, we imagine, it will be difficult to upset. There has recently been a case at Wellingborough, in which the judgment of His Honour Judge Radcliffe, K.C., might have been different had he previously had before him Mr. Justice Sargant's reasoned decision. The point was simply this. The Electric Supply Company sued a builder named Hacksley for 10s. 7d., the balance of an account for energy supplied. It seems that Mr. Hacksley has been, under an agreement, furnished with current to his private residence at 3½d. per unit—this being a special rate owing to his firm being supplied somewhere else with a considerable quantity of energy for power purposes. The Company later on gave this preferentially treated customer notice that the price would be raised to 4¾d. per unit. This notice the gentleman quietly ignored, and, in due season, declined to pay at the higher rate for the current he had used for lighting at his private residence. Hence the County Court case, and the decision of His Honour in favour of the defendant and the original agreement. What would His Honour now say on the point as to whether the Electric Supply Company are acting *ultra vires* in giving Mr. Hacksley preferential treatment? Perhaps the Wellingborough Gas Company will assist the Electric Supply Company to get the higher rate from Mr. Hacksley, by drawing their attention to

Mr. Justice Sargant's judgment, and asking the Company to kindly comply with it.

Tilney's Interpretation of the Law.

We are not cognizant of the qualifications possessed by Mr. Max J. E. Tilney, who is an Associate Member of the Institution of Electrical Engineers, for interpreting the law; but he distinctly disagrees with the interpretation by Mr. Justice Sargant of the true meaning of sections 19 and 20 of the Electric Lighting Act of 1882. It is not likely that Mr. Justice Sargant will be at all disturbed by the opinion of Mr. Tilney. The latter emphatically says that "the whole judgment appears to have been based on what one may *certainly* say was a point never in the minds of the framers of the Act and sections on which the judgment was based." Mr. Tilney apparently knows more than a Judge of the High Court about the matter of what was in the minds of the framers of the Act away back in 1882, because he says that "surely the object of sections 19 and 20 is to prevent one customer obtaining a preference over another which the other cannot obtain." Later on he remarks: "The whole point is this, that by preference is meant that one consumer is getting a supply at a rate which another consumer is unable to obtain even by complying with identically the same conditions." Supposing it could be shown that by complying with the conditions, a consumer became less profitable than he was before, this would not say much for the business acumen of the electricity suppliers. If his custom owing to its incidence became less profitable, and he was obtaining current at the same price as the more profitable consumer, then the latter would have ground to complain that an undue preference was being shown to the less profitable man. However, Mr. Tilney having spoken, what else is there to say? Simply this, that there is no Act of Parliament that allows electricity suppliers to take away a power user's liberty in the matter of the agent that he chooses to employ for lighting, and there is not an Act of Parliament that gives the electricity suppliers the right to fine a user of energy for power by charging him a higher price for that energy than is charged to another consumer because he elects to exercise his liberty in the matter of the agent he employs for lighting. We do not think Mr. Tilney need trouble himself about what effect the judgment may have upon tariffs represented, on the one hand, by the Norwich system and, on the other, by a flat-rate. Whether or not there is a preference there, is a matter that can be left for the future. There is nothing, so far as we can see, attaching to the one system or to the other that suggests any undue preference. There is no condition about the one or the other that the consumer must take, to obtain a certain price, electricity exclusively for heating, cooking, or lighting.

Increased Price and a Condition.

In our issue for March 31, we referred to the decision of the South London Electric Supply Corporation to raise the price of current from 4½d. to 5½d. per unit on account of the continued high cost of coal, with a rebate of ½d. off the 5½d., if the Company's supply is used exclusively for lighting purposes. There again we have, according to our reading of Mr. Justice Sargant's judgment, an instance of undue preference; for the consumer lighting his premises partly by electricity and partly by gas may be a more profitable consumer to the Electricity Company than the user for whom the only lighting agent is electricity. In such an instance, there would be undue preference. Distinct from the legal aspect, it seems the height of folly and a sign of weakness to make such conditions with a view of tempting business, instead of relying upon merit and fair competition. The proposed increase in price has drawn the attention of the Borough Councils within whose areas the Electric Supply Corporation operate to the fact that the per unit works' costs of the Company are low, and that the continued high price of coal is a lame excuse for augmenting the price. The Lambeth and Camberwell Councils are therefore going to make representations to the Board of Trade on the subject, to bring pressure upon the Company to vary their decision. Perhaps the increase is not the only point about the recent circular to householders in the Company's area that requires a little pressure applied to it.

The Low Power Half-Watt Lamp Again.

The rumours as to low-power half-watt lamps having been invented through the physical disabilities having been overcome continue to have vigorous circulation; but no one seems to have seen the lamps in corporeal form, and to have put them to test by the aid of photometer and meter. The "Berliner Tageblatt" has published an interview with Geh-Emil Rathenau, the Managing-Director of the A.E.G. Company of Berlin, in the course of which he discusses the prospects of small electricity concerns in the light of the trend of events. The A.E.G. Company, he states, have succeeded in producing not only 200-candle power lamps but also lamps of 50 and 25 candle power consuming "only half a watt" per candle-power-hour. The important point as to the voltage for which these lamps are intended has not been mentioned. We shall wait quite complacently for the nearer approach of the lamps, because the electricity industry is not altogether pleased with the so-described half-watt lamps of higher power. In view of the coming of the reduction of the lighting load consequent upon the introduction of these new low-consumption lamps, Herr Rathenau thinks that small electricity supply undertakings will have to amalgamate, and take their supplies of current from a large central station; otherwise they must collapse under the strain of trying to live.

The Dropping of the Illuminating Power Standard.

We recently gave an example of the "baby talk" into which "Meteor" of the "Electrical Times" lapses when he comes up against a gas topic that strikes his fancy for comment. The gas industry in looking after the long overdue change in the standard of quality of its primary product has drawn more foolish prattle from the same source. He writes: "It must be due, we presume, to the absolute contentment of our gas friends that they are moving heaven and earth to find salvation." We have not detected any particular excitement on the part of the gas industry in trying to find salvation, which word, under the actual circumstances of the industry, connotes increased prosperity. "High-pressure gas," he thinks, "might do something, but that would mean relaying many thousands of miles of rotten mains." That is rude—even from "Meteor's" pen. If there are thousands of miles of mains that are "rotten" in this country, it would be a good thing to have them replaced; so "Meteor" might do the gas industry the service of handing over his information as to their location. Then there is the dropping of the illuminating standard, to which he does not see any particular objection. There are further silly remarks about high-pressure lighting fading away, and the gas mantle becoming rare. But "Meteor" may rely upon the men of the gas industry keeping the mantle is use, the high-pressure systems extending, and, through the increased liberties in manufacturing operations, the price of gas on the decline—all to the production of a larger business than the fat sides of the industry now present.

NEGLECTED LOCAL MARKETS FOR COKE.

In view of the very inadequate prices which are being accepted for coke by many of the provincial gas undertakings, one is impressed with the anomalous position that the possibilities of local markets do not appear to have been tested. Many local authorities, operating their own gas-works and electrical power stations, have also the control of the water supply and sewage disposal. One would imagine that in these conditions—particularly having regard to the existing stagnation of the coke market—the staple fuel used would be coke, which is a smokeless and efficient fuel that is already to hand and that can at present only be disposed of under conditions giving the lowest possible return to the seller. Instead of this being the case, however, while the wits of everyone concerned are being racked to find a market for the coke produced in gas-works, other departments are being furnished with steam coal or slack, which can only be obtained at a much higher cost per unit of heating power and which, being used in place of coke, also contribute materially, but quite unnecessarily, to the aggravation of the local smoke nuisance.

In at least one well-conducted municipality, the coke surplus is often barely sufficient for the needs of the power station after the local domestic and industrial demand has been met. The published fuel costs of this electricity works, which is one of the pioneer stations, compare very favourably with those of power stations equipped with the most modern coal-burning and steam-generating plant.

Approached on the subject of steam-raising by gas coke, it is possible that the engineering authorities of the various departments may make the suggestion of consequent damage to their boilers. No Boiler Insurance Company has been known to raise the least objection to the use of coke fuel for steam raising, and no other steam-raising fuel is permitted at the gas-works of the same municipal authority.

In many cases mechanical stokers are used which would appear to bar the way to coke fuel; but mixtures of coke and coal-slack in varying proportions are giving entire satisfaction on most types of mechanical stokers without reducing, but rather increasing, the evaporative capacity of the boilers.

The most serious objection to the use of coke fuel at some electric power stations would appear to be the limited boiler capacity available. Coke is a comparatively slow-burning fuel; and to use it exclusively under the same conditions as coal would reduce the possible maximum capacity of the station. But the station may be working at its maximum capacity for only two or three hours per day. At all other periods of the day, when the load factor is lower, the use of coke fuel is a better proposition than that of putting off a number of boilers which must be again brought up to working temperature for the next peak load. By the addition of simple and inexpensive forced-draught apparatus, the maximum evaporative capacity of the boilers is obtainable with coke fuel.

The only disadvantage which can be seriously put forward as applying to the use of coke is that, weight for weight, it occupies greater space than coal. In all but very exceptional circumstances this is a difficulty that should be easily met; and in any case the advantages belonging to the use of smokeless coke as a fuel must far outweigh this single disadvantage. The economic advantages on the one hand of a reliable outlet for surplus coke and, on the other hand, a reliable source of supply of smokeless fuel and considerable reserve stock, should appeal to those responsible for the conduct of the various departments.

NEW SHOW-ROOMS AT BROMLEY FOR THE SOUTH SUBURBAN GAS COMPANY.

A FEW months after the South Suburban Gas Company acquired the undertaking of the Bromley and Crays Gas Company, the old offices and show-rooms in High Street, Bromley, were rendered partially vacant by the transfer of the rental staff to the chief offices of the Company at Lower Sydenham; and as Bromley is unquestionably one of the most important shopping and residential centres in the Company's district, the Directors decided to make full use of the premises by converting them into show-rooms commensurate with the requirements of the district.

Originally a double-fronted private house, with the ground floor some feet above street level, the premises were not suitable for show-room purposes; and a scheme of reconstruction was accordingly put in hand, which, while retaining for branch offices the upper rooms in the old building, has afforded on the lower ground floor an excellent and commodious show-room.

The upper portion of the old building and the side walls remain; but the whole front has been taken down and reconstructed in Portland stone, with an unpolished Aberdeen granite plinth, relieved between the upper windows with red-brick panels. A new wing has been added on the left of the building, balanced on the other side with a screen and gates leading to the stores at the back of the premises. The forecourt has been lowered to the pavement level, and is enclosed by brick piers and chains.

Access to the main show-room is gained through a lofty Portland stone vestibule in the new wing. This room is about 33 feet square, and has been formed by clearing every room on the ground floor within the four external walls of the old building—the upper floors being carried on stanchions.

The front floor of the show-room has been lowered to coincide with the forecourt; but the back portion remains at the old level, and the two floors are connected by a broad stairway placed centrally between stanchions. The break in the levels is surmounted by a wrought-iron balustrade.

The show-room is panelled throughout in Austrian oak to a height of 8 feet; and the frieze above is formed of some antique finished tiles, slightly decorated with a conventional design.

In the new wing is situated a complete bath-room, with tiled walls and mosaic marble floor, in which are shown gas-heated hot-water appliances of all kinds in full operation.

In furnishing and fitting up the show-room, especial care has been taken to avoid overcrowding; and although there is a complete range of well-selected and artistic fittings, and all the cookers, fires, and other appliances issued on hire by the Company are fully represented, there is a feeling of roominess about the show-rooms which is a decided aid to business.

The building was designed, and its erection supervised, by Mr. Percy Coad, M.S.A.; and the work was carried out by Mr. T. P. Duthoit, both of Bromley. It may be added that we are indebted for the foregoing descriptive notes to the Secretary of the Company, Mr. Wilfrid Wastell; while the excellent photographs we reproduce were taken by Mr. Gordon Chase, of Bromley.

Last Thursday's "Bromley Chronicle" devoted a full page to an illustrated description of the new show-rooms—giving enlarged reproductions of two of the three photographs that we are using. In introducing the matter to their readers, our contemporary remarks:

Few people will recognize in the show-rooms just opened by the South Suburban Gas Company, the old gas offices at No. 156, High Street; and it may well be asked how it comes about that such handsome and commodious show-rooms are justified when there are some who would have us believe that the days of the gas industry are numbered. The answer to this is twofold. In the first place, the number of gas consumers in the Bromley district twenty years ago reached a little over 2000, whereas to-day in the Bromley district there are nearly 13,500 out of 65,000 consumers on the books of the South Suburban Gas Company. In the second place, all progressive gas companies have realized the necessity for maintaining throughout their districts well-equipped show-rooms, in which customers may see modern appliances, and obtain advice as to their use. These appliances are so multifarious, and their uses so varied, that it is difficult to conceive a home in the domestic economy of which gas does not play a very important part. In the Bromley district, particularly, recent development has been so rapid that the Directors of the South Suburban Gas Company felt themselves justified in producing what is undoubtedly one of the finest business premises Bromley possesses.

Pasteurizing Milk with a Gas-Fired Boiler.

An article on "Gas Fuel for Industrial Purposes" in the May "Bulletin" of the American Commercial Gas Association contains an illustration of a typical milk-pasteurizing plant with automatic gas-fired boiler, accompanied by particulars of an actual test. The work was performed by the dairyman with the assistance of a lad. It was started at 2.15 p.m. by lighting the gas-burner under the boiler. This was done by the boy, who busied himself washing bottles while the boiler was making steam. At 2.30 p.m. the steam-gauge hand had started to move; showing that it required only 15 minutes to indicate steam. The dairyman did not appear until 2.50, at which time the boiler had 38 lbs. steam pressure. At 2.55 the steam was passed into the pasteurizer water-jacket to heat the water. This required five minutes. At 3.02 milk was placed in the receiving vat, from which it is passed into the pasteurizer. The milk was started through the latter at 3.05, from which time onward the steam pressure fluctuated, owing to the varying quantity of milk in the pasteurizer. From 3.04 onwards the assistant bottled the milk as fast as it left the cooler. The process started with 2½ gauges of water, and no more was put into the boiler until all work was completed. At 3.39 there had been evaporated 1½ gauges of water. At 3.47 the gas-burner was extinguished, the 47 lbs. of steam pressure being sufficient to pasteurize the remaining milk. At 3.45 every gill of milk had been pasteurized, bottled, and placed in the ice-box. The remaining steam furnished hot water for cleansing the premises, &c. At 4.35 p.m. the dairyman had finished.

New York Water Supply.

A joint meeting of the Society of Engineers and the Institution of Municipal Engineers was held on Monday, the 11th inst., when a paper was read entitled "Notes on the Water Supply of Greater New York," by Mr. W. T. Taylor, of Burnley. He has made several inspection trips over the works he described. The population of Greater New York, as estimated at July 1, 1913, was 5,373,000; and in order to keep pace with its growth of (approximately) 135,000 persons per annum, it was long ago recognized that additions to the water supply system would be inevitable. The source eventually selected was the Catskill watershed, about 100 miles distant from New York, having an area of nearly 900 square miles. The outstanding features of the works are the Ashokan reservoir, having a capacity of 128,000 million gallons, and an area of 8000 acres; and the Catskill aqueduct, the longest and deepest in the world, with a capacity of 500 million gallons a day. The Board of Water Supply consists of three Commissioners, appointed by the Mayor of New York, and assisted by a large number of technical experts and assistants; and the author described the organization of the engineering bureau, which is divided into five departments. The Kensico reservoir, to the east of the Hudson River, has a capacity of 29,000 million gallons, and will act as an emergency storage reservoir, so that the supply will not be interrupted in case of inspection, cleaning, or accident on the 77 miles between it and the Ashokan reservoir. The paper concluded with a description of tests made on specimens of concrete and metal during the progress of the works.

NOTES FROM ABROAD.

Gas-Range Production.

The City of Cleveland claims to be the largest producer of gas-ranges. It is said that the eleven firms making these appliances in the city turn out a total of 240,000 a year, costing over 4½ million dollars. That one city alone produces so many gas-ranges is good proof of the popularity of this useful household appliance.

Progress in Rio de Janeiro.

Last week a short note appeared in these columns on the excellent public lighting enjoyed by Rio de Janeiro. Apparently the progress of the city in the use of gas is not confined to its use for lighting, for we learn that an American firm, after successful trial orders, is shipping water heaters to the city at the rate of 140 per month, with orders to continue till countermanded.

When to Start-up New Works.

In the course of a paper recently read before the Southern Gas Association of America, Mr. C. M. Crawford advises that companies supplying new areas should turn on the gas in the month of May; firstly, because the consumer has the long summer months in which to fully appreciate the gas-cooker; secondly, the company has the whole summer in which to secure customers and instruct them in the economical use of gas; and thirdly, those consumers who are secured for the lighting business receive their first bills when lighting costs are decreasing. This leads to satisfaction, and gain of other consumers.

Japanese Gas Association Meeting.

The Imperial Gas Association of Japan held its second ordinary general meeting on April 11 in Tokyo. About 200 members attended. The report of the proceedings for the past year was read, new officers elected, and lectures given; the day ending with a dinner. In the same building as the meeting was held there was also an exhibition of gas appliances, which attracted several thousand visitors, and was considered quite a success. A fuller account of the meeting is promised for a later issue of the "Journal" of the Association.

Benzol Recovery in U.S.A.

A considerable addition to the supply of commercial benzol in U.S.A. is expected from the recent decision of the United States Steel Corporation to extend and improve the bye-product coke-oven plant worked by the Carnegie Steel Company at Farrell, Pennsylvania. A sum of nearly $500,000 is to be spent on the work, which is to include a Carl Still benzol recovery plant, and the bye-product recovery plant at Farrell will then be the most complete and up-to-date of any being worked under the Steel Corporation.

Prepayment Meters in Japan.

The "Journal of the Imperial Gas Association of Japan" expresses regret that prepayment meters are so little used except in Tokyo and a few other of the largest cities—and there not extensively. Nagoya, a town in the centre of Japan proper, is, however, installing them, and other towns of similar size may follow suit with benefit to themselves and their consumers. The Nagoya Company needs to make some such effort as this, as it has recently been struggling hard for business against the local electrical undertaking, with the result that both had cut their prices to a point where there were no further profits. Recently, however, a conciliation has been reported, which seems certainly a wiser step than excessive price-cutting.

Gas Standards in U.S.A.

The Public Service Commission of Pennsylvania has issued new regulations for the gas supply. A minimum pressure of 1½ inches and a maximum of 8 inches are allowed for manufactured gas, and the same minimum, with a maximum of 14 inches, for natural gas. A monthly average calorific value of 570 B.Th.U. is to be enforced for artificial gas, except such as shall be deemed a bye-product from coke manufacture, which is allowed to average 550 B.Th.U. The absolute minimum allowed at any time is 520 B.Th.U. for artificial gas, 500 B.Th.U. for bye-product gas, and 800 B.Th.U. for natural gas. The total sulphur content must never exceed 0·3 grain per 100 cubic feet. An error not exceeding 2 per cent. is allowed for meters.

Chance of Economizing.

Mr. N. G. Near recently expressed his opinion in the "Iron Age" that often far more money is paid for lubricating oil than is necessary; engineers thoughtlessly assuming that higher-priced oils must necessarily be better. He says that the three most important tests can be made without special apparatus quite well enough for comparison—the flashing test with a thermometer, the gravity test with a pair of scales, and the viscosity test with a tin can with a hole in its bottom. He recently found an engineer using an oil similar in appearance to his own, but at four times the price. He tested the two by running a machine with each at normal speed, touching a switch, and taking the time required to come to a standstill at no load. His cheaper oil actually proved to be superior to the other.

Much-Needed Regulation Promised.

It is reported from Japan that the shares of the principal gas companies over there are at a low price, and that business is not wholly satisfactory at the moment. It has been suggested in the National Diet that there should be State regulation of the gas industry, so as not to allow local authorities to please themselves in each individual case. A Committee has been appointed on the subject. It seems that a system without any general standard to govern price, quality, &c., must lead to mistrust on the part of the people, and a good example is that of the Chita Gas Company. Having almost completed an electricity branch, and so obtained practically a monopoly in light, heat, and power, the Company announces its intended prices for current, which are found to be higher than those of any of the neighbouring undertakings. Needless to say the people would not have any of this, and threatened not to use the gas either if the Company persisted. Such incidents as this can do the industry in Japan no good at all.

WORKS TOPICS.

By "Modus Operandi."

The Advantage of a Test Holder.

The careful regulation of the quality of the gas made is undoubtedly a matter of growing importance. This being so, any apparatus or system which will facilitate such careful regulation is likely to be useful. In many works it is usually the case that the gas made during the daytime is much more carefully watched and regulated than the gas made at night. I do not suggest that this is intentional; but owing to the absence of all chief officials at night time it goes without saying that there is bound to be lack of supervision which is not wanting in the daytime.

The use of recording calorimeters is, of course, an excellent method of keeping control over night work. Such an appliance is becoming a necessity in all modern works. It is, however, in connection with another apparatus that these remarks are made; for in practice it has been found that a test holder can be used to very great advantage, if properly fitted for the purpose. Such a holder can be connected to collect the make during night hours, and give a record in the daytime of the average quality made. By this means, the manager can make certain that the night work has been properly carried out; for here is a faithful record of the work waiting to be tested.

The holder should be connected to the photometer and calorimeter, and be weighted so as to give the desired pressure. Such records of night work should, it goes without saying, compare well with the day's records; and the use of such an apparatus enables the manager to call to account any disregard of the importance of faithfully maintaining the quality of the gas made at night time. This method also enables the chemist to collect average samples for analysis.

Packing for Liquor Pumps.

In the discussion on Mr. Edmondson's paper, recently read before the Manchester and District Junior Gas Association, a question as to the best means of packing the glands of ammoniacal liquor pumps was asked by the President (Mr. J. M'Nicholl, of Warrington). So far as I can see, the question was not answered; but having quite recently found a very efficient packing for this purpose, I am glad to have the opportunity of replying to the query. Mr. M'Nicholl should try square mineralized indiarubber of good quality. It can be purchased in coils and cut to suitable lengths. In my own case it showed a very considerable advantage over all other kinds of packing for this particular purpose.

Increasing the Capacity of Boilers.

In those works where additional boiler power is under consideration, or where the boilers are already overtaxed, it is a very good plan to make a change in the fuel used. It is assumed that in these cases gas-works' coke, and not breeze, is used; for the latter would not, in such circumstances, be a good enough fuel to keep steam in a boiler taxed to its utmost. In using coke, or, in fact, any fuel, a very important factor is its size. It is all a question of surface area in the first place, and air space between the fuel in the second place. Combustion in the case of a large lump of coal or coke, when fired into a boiler, is obviously limited to its outer surface—for some time at any rate. This being so, the area of the outer surface in the case of a large lump is small compared with its inner contents, whereas in the case of a small piece the outer surface is relatively large. For instance, if we take a piece, measuring 1 in. by 1 in. by 1 in., and another piece 3 in. by 3 in. by 3 in., we see that the outer surface area in the case of the former is 6 square inches and its cubical capacity 1 inch, while in the case of the latter the outer surface area is 54 square inches, and its cubic capacity 27 inches. Thus while the cubic capacity is 27 times greater, the outer surface area is only 9 times greater. This fact fully explains the reason that small boiler fuel of (say) 1 inch cube is so much more efficient than large fuel of the size already mentioned.

It is an undoubted fact that a boiler fired by small coke will evaporate with the same draught quite 30 or 40 per cent. more water than one fired by large coke, though it will use a proportionately larger quantity of fuel. If, however, the size be reduced to too great an extent—the limiting line being somewhere about ¾ inch cube—the air space between the pieces becomes too restricted, and the burning capacity of the grate is diminished.

To break the coke there is no doubt that a machine of the "cutting" type is far more effective than those that rely on a crushing force to do the work.

CARBONIZING PLANT AT THE ROCHDALE ROAD GAS-WORKS OF THE MANCHESTER CORPORATION.

By J. G. Newbigging, M.Inst.C.E.

[Prepared for the Meeting of the Manchester District Institution of Gas Engineers, Saturday, May 23.]

The Rochdale Road Gas-Works has been selected for the visit of the Institution to-day, because the carbonizing plant at these works is illustrative of the gradual progress which has been made, step by step, in methods of distilling coal for the production of town gas.

There are three retort-houses, two of them containing horizontal retorts. One is equipped with West's charging and drawing machines driven with compressed air, and the other with the Fiddes-Aldridge simultaneous charging and drawing machine driven by electricity obtained from the Corporation supply. The third house formerly contained horizontal retorts and West's charging and drawing machines; and these have recently been replaced with an installation of Glover-West continuous working vertical retorts.

Retort-House with West's Charging and Drawing Machines.

This house, known as the "B" retort-house, contains eighteen settings of nine through retorts in each setting, 22 in. by 16 in., in section, and 20 feet long. The coal carbonized per day averages about 195 tons; and the telpher system is in operation for the removal of coke from one end of the house, to which point it is conveyed by coke wheelers, and quenched, before discharging into the telpher-skips.

The working costs for three shifts of eight hours are 29·95d. per ton of coal, and include all labour from coal to the retorts to coke to the yard, maintenance of all machinery connected with these operations, cost of steam, oil, waste, &c. It will be seen from the figure of 29·95d. per ton that the cost is very little lower than hand work; and the house will be remodelled as soon as it can be spared for a sufficiently long period, and one or other of the modern systems of carbonizing installed.

The method of conveying the coal to the charging machines is worthy of notice, because I believe it is the origin of the gravity-bucket system of conveying coal or other material. Over thirty years ago it was first applied to one of the retort-houses at the Salford Corporation Gas-Works, and immediately afterwards to this retort-house by the late Mr. John Woodward, of Manchester—a gentleman of considerable mechanical genius. The prevalent impression that the gravity-bucket system of conveying coal is an American idea is therefore wrong.

Retort-House with Fiddes-Aldridge Stoking Machine.

This retort-house was formerly equipped with a charging and drawing machine on each side of the bench. The power for propelling the machines along the floor of the house, and for charging and drawing the retorts, was obtained by means of a 3 H.P. gas-engine fixed on the framework of each machine; the supply of gas to the engines being obtained by means of flexible tube. So far as I am aware, these were the only machines which had ever been made of this type. Three years ago these machines were dismantled, and a Fiddes-Aldridge machine, driven by electricity, installed to the same retort-bench. The retort-bench was not reconstructed, because it is intended to equip this house with vertical retorts as soon as practicable—the height of the house lending itself to this system.

The bench consists of nineteen settings of six retorts to a setting 24 in. by 16 in. in section and 20 feet long, and the total cost of labour, including coal to the retorts and coke to the yard, maintenance of all machinery, electric current, oil, waste, &c., is 15·26d. per ton of coal dealt with, averaging 130 tons per day.

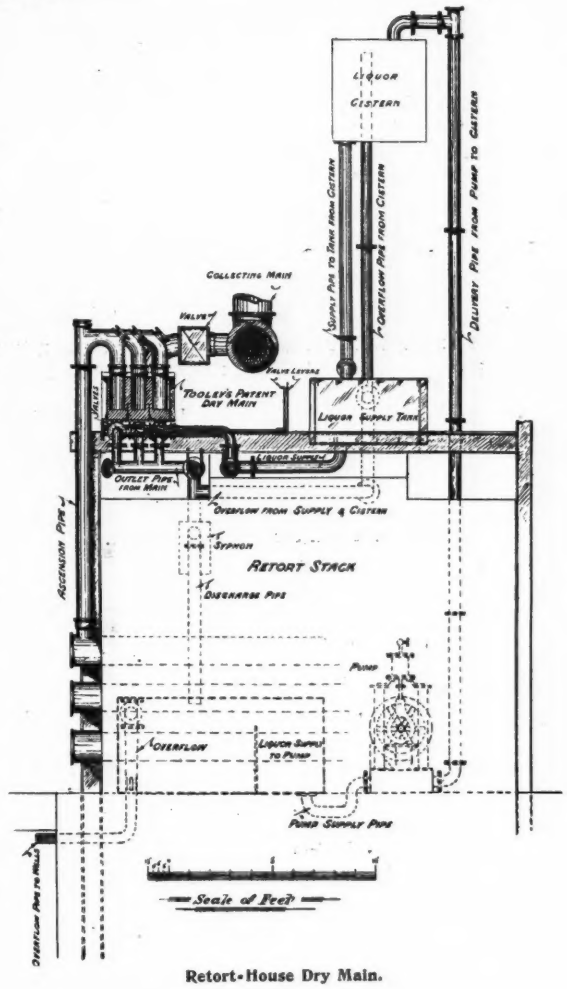
This house is fitted with a dry main (the invention of Mr. G. W. Tooley, the Manager of the works), which has novel features. The main is divided longitudinally into three sections, and is so arranged that the dip-pipes from each of the three tiers of retorts are placed in separate sections. The object of this is to ensure that only the retorts which are being discharged shall be under seal, leaving the other retorts in the setting free from seal. Retort-house governors are worked in connection with the main, and neither the main nor the governors have given the least trouble. The main is quite free from tarry matter, and on no occasion has an ascension-pipe been stopped. The illustration will show the working of the main.

Glover-West Vertical Retorts at Rochdale Road.

The successful results obtained from the working of the Glover-West continuous system of carbonization in vertical retorts at the Droylsden station, where the plant has been in continuous operation since July, 1910, induced the Corporation to extend the system to the Rochdale Road works, and to adapt an existing retort-house for the purpose.

The retort-house occupied by the present installation of vertical retorts formerly contained eighteen settings of nine through retorts, 22 in. by 16 in. ⌂ section by 20 feet long, and was capable of producing from 2 to 2¼ million cubic feet of gas per 24 hours. The new installation of vertical retorts contains sixteen settings of eight retorts, arranged in two separately controlled benches in line with each other, and capable of producing 4 million cubic feet of gas per 24 hours. It will therefore be noted that the productive capacity on the same ground area is almost doubled.

The daily supply of coal to the retort-house is brought by overhead railways to two coal-breakers, one on each side of the retort-house. These breakers are provided with hoppers for receiving the coal; mechanical feeders to regulate the supply of the coal to the breakers; and elevators for raising the coal to coal-conveyors extending the whole length of coal-storage bunkers above the retort-benches. Each retort-bench has its separate conveyor, and arrangements are made so that either coal elevator from either breaker can deliver the coal to either coal-conveyor. The total capacity of the coal-handling plant is 70 tons of coal per hour.



Retort-House Dry Main.

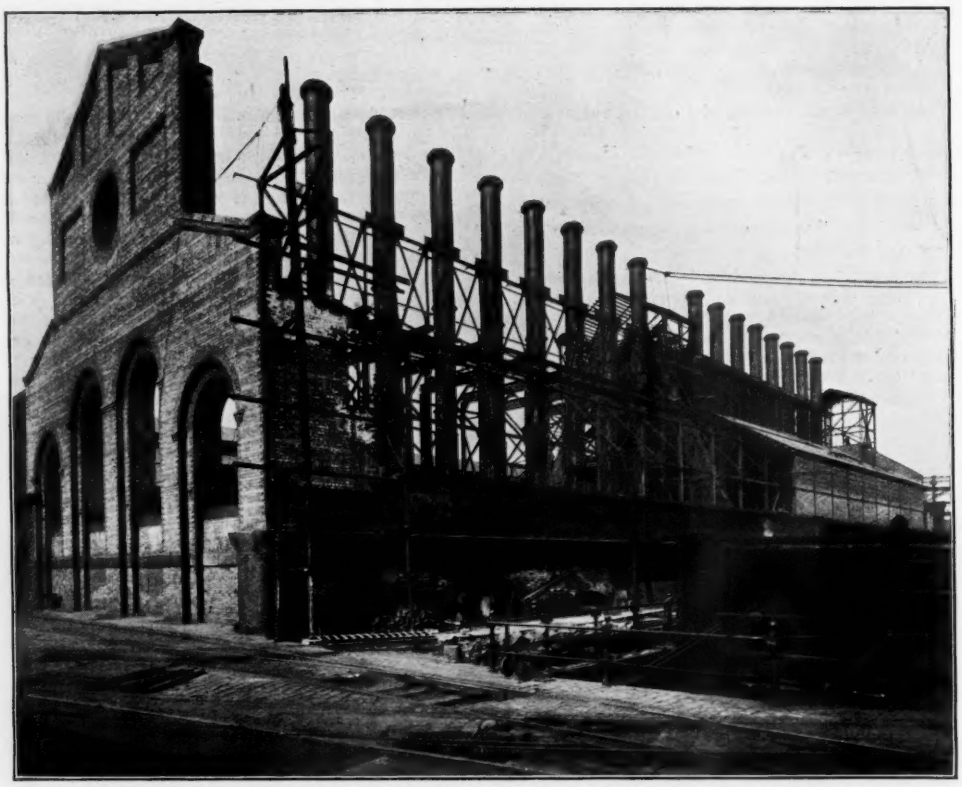
The storage bunkers above the retort-benches are of a capacity to hold 48 hours' supply to the retorts, and are constructed of strongly braced steel plates. They are provided with 128 outlets, corresponding to the number of retorts in the installation.

The means for transporting the coke from the retort-house to the stores is of a special character, and comprises a system of electric railways in conjunction with an existing telpher transporter and storing plant.

Details of the New Plant at Rochdale Road Works.

The general description of the Glover-West vertical retorts at the Rochdale Road Gas-Works is in many respects similar to that given in the paper which I had the honour of reading before the Institution of Gas Engineers at their meeting in Glasgow in 1911; but it may not be out of place to state here the principal features of the system, which are as follows.

The Glover-West vertical retorts are continuously fed with coal, and the residual coke is continuously discharged from the retorts by mechanical means provided with special speed regulation for controlling the rate of discharge of the coke, and thus the plant can be readily adapted to suit the time required for the complete carbonization of different kinds of coal.



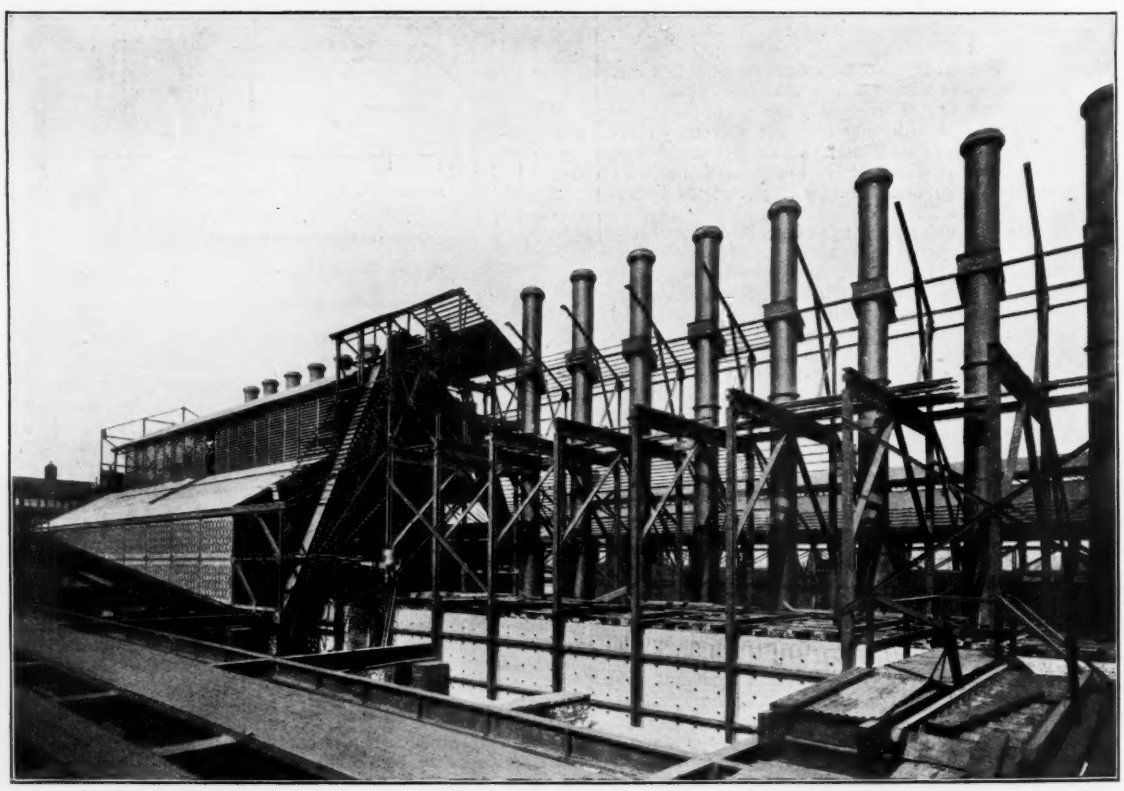
THE RECONSTRUCTED RETORT-HOUSE AT THE ROCHDALE ROAD (MANCHESTER) GAS-WORKS, CONTAINING THE INSTALLATION OF GLOVER-WEST VERTICAL RETORTS.

The coal is broken, elevated, and stored in bunkers above the retort-bench as before described, and is fed to the retorts through gas-tight coal-valves and feed-hoppers, arranged so that each retort has a continuous separate supply, and the coal is in continuous flow to and through the retorts. The coal during its continuous descent through the retorts is completely carbonized by the time it arrives at a point near the base of the retort.

The residual coke, when passing through the lower end of the retorts, is cooled by air which circulates around the base of the retorts. This heated air forms the secondary air supply to the combustion chambers, which are arranged in horizontal floors—each floor being separate from the other.

The producer gas rises from a common generator through vertical flues to the combustion chambers, and is admitted to them through nostrils controlled by dampers. The waste gases from each combustion chamber pass through flues and circulating chambers around the top ends of the retorts, and make their exit to a chimney. Each setting of Glover-West vertical retorts is provided with a separate chimney.

Each retort is fitted with a worm coke extractor, which dis-



VIEW FROM THE COAL-STORE OF THE GLOVER-WEST VERTICAL RETORT INSTALLATION AT THE ROCHDALE ROAD WORKS OF THE MANCHESTER CORPORATION.

charges the coke to a coke receiving-chamber periodically through an outlet fitted with a sealed door.

At the top of each retort there is a mouthpiece and gas-outlet pipe, with ample provision of inspection holes and covers. The eight outlet pipes from each setting lead into a rectangular section collecting and condensing main, which is common to the eight retorts, and is provided with gas and tar outlets and valves, so arranged that the main can be periodically flushed. Both gas and tar outlets are connected to 24-inch diameter steel foul gas mains, one to each bench, and at the outlet end of these mains there is a 16-inch Braddock retort-house governor, with bye-pass valves and connections, and a tar seal-pot.

The retorts are built in settings of eight retorts each, and are arranged in units of four retorts, so that only one-half of each setting may be in operation if required. The retorts of the installation at Rochdale Road are 23 feet long, and measure 27 in. by 10½ in. at the top, and enlarge to 33 in. by 18 in. at the bottom end.

The portion of the retorts subjected to the heating gases are of special composition of fireclay, and are truly made without obstructions to the descent of the coal. The bottom ends of the retorts are constructed of special silica fireclay grooved and tongued blocks in the horizontal and vertical joints. The retorts are made in sectional lengths corresponding in number to the secondary air, combustion chambers, and circulating flues, and are provided with ledges on which the floor tiles are supported. With the exception of the end walls of the retort-benches, the benches are constructed of specially selected fireclay materials; those in the combustion and circulating chambers being lined with best silica fireclay materials.

The producers in the installation at Rochdale Road are of the fire-bar type, similar to those in operation at Droylsden station. The furnaces have double clinkering doors, to which primary air inlets and adjustable slides are fitted. The firing door frames at the mouths of the producers are of the sand-luted type, and are provided with light pressed steel lids which are easily lifted by hand. The ash-pans are of steel plates and angles set in a brickwork bed laid in cement mortar. The furnaces are provided with a water supply, each furnace having a top spray-pipe and an overflow pipe to an outside gulley laid in the retort-house floor.

The retort benches and furnaces are braced with 18 in. by 7 in. steel H section front and back buckstays provided with cleats receiving 8 in. by 5 in. and 8 in. by 4 in. steel H section horizontal bracing, and the end buckstays are bound to the front and back buckstays by steel plates and angles. For tying the end buckstays at the top of the bench, there are three lines of longitudinal tie-rods with link-couplings and screwed ends.

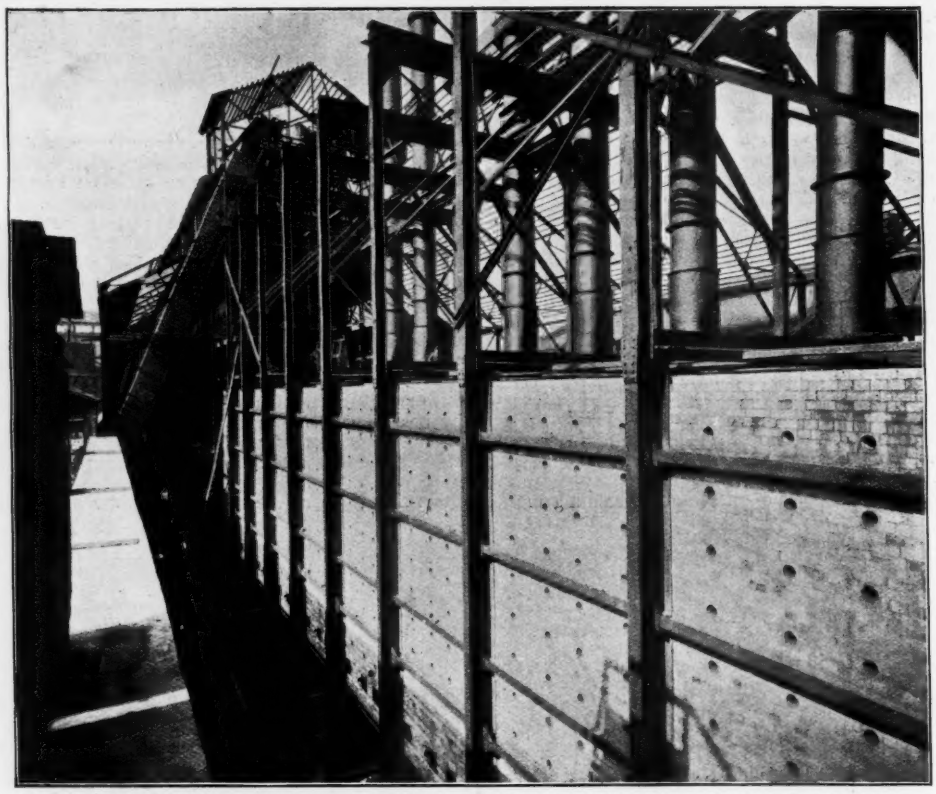
The whole of the retort-setting rests upon a steel girder floor composed of 15 in. by 5 in., and 15 in. by 6 in. main girders, with 6 in. by 3 in. trimmers, arranged with spaces to receive the coke-extractor worm casings. The main girders spanning between the front and back buckstays are strongly cleated to them, and form the bottom ties of the retort-benches. The whole of the superstructure of the retort-benches is supported on brick piers, which are of the Huncoat special quality engineering bricks set in cement mortar. The producer bracing is of 6 in. by 6 in. by ½ in. angles, with 6 in. by 3 in. channel horizontal stays.

For attending to the plant there is a lift, which is placed at one end of the retort-house, and is of sufficient height to reach from the ground level to the top of the coal-bunkers. It is fitted with a 7 ft. square cage, and is capable of lifting 20 cwt. Collapsible safety gates are provided at each floor and in the cage. This lift, in addition to serving the purpose of gaining access to the plant, is also used for raising the coke to a coke-hopper above the retort-bench for the supply of coke required when starting-up the plant and after the retorts are scurfed. The coke-hopper is arranged to feed a travelling shoot suspended from an overhead runway, which enables the shoot to be readily brought to any retort on the plant. The lift may be used as an auxiliary means for raising coal to the bunkers and coke for filling the producers.

The coke discharged from the retorts is received by telpher skips, which are supported on the carriages of two electric trains. These run on a single track extending the full length of the retort-house and to termini immediately outside and at one end of the retort-house, where the railway lines diverge into two tracks to enable the skips to be brought-to directly below the existing telpher track on which there are two telpher machines, which lift the loaded skips from the carriages and transport them to coke-hoppers and the yard store, and return the emptied skips to the railway carriages. For the convenience of dealing with the large quantity of coke that this plant is capable of producing, there are two sets of locomotives and skip carriages, so that while one train is waiting below the telpher track and being unloaded, the other train will be engaged in obtaining a further supply of coke. Each train consists of one electric locomotive and two skip carriages, arranged so that, without shunting, the two skips can be brought immediately below eight coke outlets of any two settings. Each skip is capable of holding the coke discharged from four coke-chambers. The train tracks are provided with automatic points; thus enabling one man to attend to the driving of both trains.

The whole of the coke from the plant, after leaving the retort-house, is dealt with by the telpher machines, which, in addition to transporting the coke to the yard store, also transports the coke required for the furnaces to an elevated hopper immediately below the telpher track and opposite the centre of the retort-house. From this hopper there is a conveyor for transporting the coke to two coke-hoppers, each of a capacity of 6 tons, and fixed above the centre line of the producer charging doors; and from this hopper the coke is supplied to producer charging waggons which run along rails laid on the producer charging floor.

THE GLOVER-WEST VERTICAL RETORT-SETTINGS IN COURSE OF CONSTRUCTION AT THE ROCHDALE ROAD GAS-WORKS OF THE MANCHESTER CORPORATION.



INSTALLATION OF GLOVER-WEST VERTICAL RETORTS IN COURSE OF CONSTRUCTION AT THE ROCHDALE ROAD GAS-WORKS OF THE MANCHESTER CORPORATION.

The whole of the plant is provided with staircases, ladders, and platforms, for access to the producer charging stage, the sight-hole dampers on each side of the retort-bench, the charging stage of the retort-bench, coal bunkers and conveyors, inspection doors of gas-mains, retort-house governors, and bye-pass valves.

The motive power for driving the various parts of the plant is electric throughout. Current of 400 volts, D.C., is obtained from the Corporation electricity supply. The whole of the stationary motors are compound wound; those for the electric motors are series wound. All are totally enclosed and dust-proof, and provided with special starters and controllers with an ammeter for each starter.

The Alteration to the Building.

As before stated, an existing retort-house was adapted to receive the new installation. To do this, the side walls were raised by the additions of structural steelwork with 4½-inch brickwork panelling having bricks left out for light and ventilation. The gable end walls of the retort-house were strengthened and raised; one end by solid brickwork and the other by steelwork and brick panelling as for the side walls.

The roof principals are of steel, and there is a louvre roof above the coal bunkers and conveyors. The covering of the roof is of Duchess slates nailed, by special composition nails, to a wood filling fastened to steel angle lath purlins. Both sides of the main roof are provided with Mellow's patent roof glazing, so that there is an ample provision for lighting the retort-house.

It is too early to speculate as to what the labour and maintenance of machinery costs will be per ton of coal dealt with in the house, but that they will reach a low figure there is no reason to doubt.

GAS IN THE PRINTING TRADES.

The Fifth International Printing and Allied Trades Exhibition, which is now being held at the Royal Agricultural Hall, is a remarkably good show. The ground-space is covered with wonderful machinery (a great deal of it in motion), and with various appliances and commodities useful to the printer in carrying on his business. One of these commodities—and a very important one—is gas, which visitors will find to be worthily represented by the Gas Light and Coke Company. The great home of the newspapers in London is, of course, in the Company's area of supply; and efforts have for a long time been successfully made by them to increase business in this direction. Occasions will be recalled on which the Controller of Gas Sales (Mr. F. W. Goodenough) has made special reference to the matter at technical gatherings—perhaps the last occasion being the paper read by him, on the "Illumination of Printing Works," before the Illuminating Engineering Society in March, 1912 [see "Journal," p. 872]. At the Islington show, a larger public is appealed to; and of the enormous number of visitors to the exhibition, by far the greater proportion must have their works outside the area of the Gas Light and Coke Company. So that while benefiting themselves, the Company are also benefiting others.

The two stands are in the Gilbey Hall, which, by the way, is lighted by a number of 1500-candle power Keith high-pressure lamps, with hexagonal clear glass screens and no globes. At one of the stands there are shown a number of Keith compressors; four of the rotary type being connected up. Of these two are used in connection with the lighting, and the other two for supplying compressed air for the industrial appliances. A number of inverted incandescent lamps are fitted, of the Keith, Sugg, "Nico," and Bland types, particularly suitable for factories and workshops. Well as lighting for workshops is represented here, the many ways in which the printer, &c., may advantageously employ gas industrially are just as thoroughly demonstrated on the second stand. This is filled with furnaces and other industrial appliances, by Messrs. Fletcher-Russell, Richmond, and John Wright; many of them being shown in action.

There are (in addition) muffle furnaces, crucible furnaces, glue-pot heaters specially designed for the bookbinding trade, radiators suitable for printing works and factory warming, lead melters for printers, and the "B.T.U." circulator. A particularly interesting thing is an ingenious little forge, which was specially designed for straightening shafting. This is found to be very valuable in large printing works. Many of the furnaces, &c., can be seen in operation; and it is gratifying to learn that the Company are doing good business at the stands, as well as making known to the trade in general the endless variety of purposes to which gas can be economically and suitably put. The display is an eminently practical one—in fact, just what is wanted at an exhibition of this character.

Gas is used at a number of the stands in different ways—among others by the Monometer Manufacturing Company, Limited, of Aston, for their low-pressure gas melting furnaces, fitted with self-acitng heat-regulator, which prevents the temperature from rising above any desired degree.

At a recent meeting of the Royal Society, Sir William Crookes read a paper containing the results of experiments carried out in connection with the absorption of ultra-violet and infra-red rays and the reduction of glare. At the last *conversazione* of the Society, Messrs. Chance Bros. and Co., Limited, showed a number of specimens of glass for making spectacle lenses for the purpose named. Some of them were capable of almost completely absorbing the heat and ultra-violet radiations, and were useful for many purposes besides spectacles.

EVENT AND COMMENT.

[COMMUNICATED.]

IN his presidential address at the recent meeting of the Iron and Steel Institute ["JOURNAL," May 12, p. 422], M. Adolphe Greiner dealt very exhaustively with the possible economies in working blast furnaces, coke-ovens, &c., and laid especial stress on the fact that we were a long way yet from getting the most out of the various classes of raw material which we utilize. The general principles of his address hold good in all cases where coal is utilized. More and more are collieries and iron works becoming chemical works; and there seems no limit in the direction of development which might be expected in these quarters. He also referred to the Feld and Burkheiser processes for the utilization of the sulphur in the gas. These processes have not been heard of very much of late; but the writer is given to understand that they have by no means been allowed to drop. He also understands there is another type of process being investigated working on entirely different lines, and there are certainly very great possibilities in the new process. Much detail is not yet available. But it is said that no complicated reactions are involved, and, indeed, the principal reaction is one which is already carried out with the utmost ease on a number of chemical plants.

WORKING-UP THE CRUDE PRODUCTS.

IT has been remarked in the preceding paragraph that collieries and iron works are also becoming chemical factories. This is indeed true, especially where bye-product coke-ovens are in operation, and the tendency is more and more towards the working-up of the crude products into finished products on the plant itself. At a good number of installations tar-distilling plants are being installed, where formerly the whole of the tar went in bulk to the distiller. Numerous plants also are now refining their benzol and selling it for motor purposes, whereas formerly the crude benzol was exported in bulk. The next development (indeed this has already taken place in one to two instances) will be the manufacture of derivatives from the various chemicals—products such as dye stuffs, disinfectants, varnishes, &c. In some cases where the coke-ovens are operated in connection with iron works, the slag from the iron works, which has hitherto been a waste product, is being broken up, treated with dehydrated tar, and sold for road-making purposes. This points to a very profitable source of revenue, and at the same time enables the companies concerned to dispose of an otherwise worse than worthless product.

COMMERCIAL UTILIZATION OF PEAT.

THE commercial utilization of peat is a problem which is always with us, and many attempts have been made to solve it. Up to the present time, however, it can hardly be said that the problem has been solved, though it is fully realized that if only peat can be dried at a low cost it is a paying proposition to carbonize it and recover the bye-products. At one or two places, Mond gas installations using peat as a fuel have been successfully operated, and very high yields of ammonia have been obtained. It is really necessary, however, to have a satisfactory outlet for the tremendous volume of gas which is produced; and if the gasification of peat could be worked in conjunction with a power station, the possibilities of success are greatly increased. The writer has just had brought to his notice another development in this problem. The air-dried peat is taken in a disintegrated form, and is mixed with low-grade fuel of an inferior quality—such as coke breeze, coal dust, colliery refuse, &c.; and this is gasified in a producer. In this way the high percentage of moisture in the peat is counterbalanced to some extent, while at the same time the difficulty of operating gas-producers on dust or very fine material is partially obviated. One company near Doncaster is actually carbonizing peat briquettes, and the peat coke formed is being utilized in neighbouring steel-works. It is said to be an excellent fuel, owing to the fact that it is comparatively free from sulphur; but no information is available as to the quantity of bye-products which can be recovered in this way.

THE RECOVERY OF TAR.

MOST of the modern developments in bye-product recovery processes really contain nothing new in principle, but are only different methods of attaining the same end—*e.g.*, in the recovery of ammonia by the direct process the condensation, scrubbing, and subsequent distillation are done away with, and the ammonia is extracted from the gas directly by means of sulphuric acid. A similar state of affairs holds good with regard to tar. On carbonizing plants the tar is contained in the gas, and the latter is then cooled and scrubbed in order to recover the whole of the tar. The tar is then separated, again subjected to distillation, and fractionally condensed into the various distillates—such as light oil, middle oil, heavy oil, &c. Taking the analogy of the direct process (though one must admit that the resemblance is not too great) could it not be possible to fractionally condense the tar in the first instance, and so save the cooling and subsequent distillation? The principle is exactly the same as that involved in the direct recovery process; but, of course, there are other difficulties to contend with. It seems, however, that something of this sort will be brought about possibly by agitating the tar in a stream of hot gas, and then passing the gas through condensers regulated at certain temperatures in accordance with the fractions it is desired to obtain. It is not altogether outside the possibilities that eventually such a process will be set to work.

SOUTHERN DISTRICT ASSOCIATION.

Visit to Norwich.

At the invitation of Mr. Thomas Glover, the President, the Spring Meeting of the Southern District Association of Gas Engineers and Managers was arranged to take the form of a visit to Norwich, the city over whose gas interests Mr. Glover so ably presides, on behalf of the British Gaslight Company. Accordingly, on Thursday last those of the members who were fortunate enough (and energetic enough) to be able to make an early start left Liverpool Street Station by the 8.23 breakfast train, under the guidance of Mr. H. C. Head, of Winchester, the Hon. Secretary, in grand summer weather. The members of this advance guard—numbering 15—were met at Thorpe Station, Norwich, by the President and Mr. H. Collins, Assistant Borough Surveyor of the City, who is shortly to take up a new post at Colchester. A motor drive through the streets of the old cathedral city, which was looking its best bathed in warm sunshine, brought the members to the Newmarket Road, where they were able to see Mr. Glover's macgrouting process actually in course of application by the Corporation men.

ROAD MACGROUTING.

Although Mr. Glover described the process in his Presidential Address to the Association so recently as March 12 last, it will not be out of place to repeat some of the details of what may prove so important an advance in road surfacing. When the party arrived on the spot, the dry stone was laid and rolled, and ready to receive the dressing. The specially prepared pitch or macgrout is then heated up, and is intimately mixed with one-third part by weight of fine, dry sand. The mixture, after being well stirred, is then poured on the road by means of ladles, and the steam roller passed over the surface. After a few minutes another dressing is applied, which is spread evenly over the surface by means of a squeegee, a sprinkling of fine dry shingle added, and the roller again passed over. The surface is then complete. A piece which had been laid the previous day was cut out for the inspection of members. It is a curious fact that the macgrout does not adhere to the lower surface, but is like a solid covering, 2½ inches thick, which can be raised at any point where a pick is inserted just like a table-cloth. Admiration was expressed at the solidity of the surface, the dressing working into every nook and cranny, thus leaving no weak spots such as are often found with ordinary methods of tar-spraying. The ease and rapidity with which the process is carried out were also subjects of favourable comment. It would not be surprising if this system, the result of much study and experimenting, proved to be a revolution in the making of roads to suit modern conditions of traffic.

ST. MARTIN-AT-PALACE GAS-WORKS.

On the way to the gas-works, a call was made at the Guildhall, the ancient beauties of which were pointed out to the members by Mr. Collins, after which a short drive brought the members to Mr. Glover's manufacturing station. Although the majority of them had inspected the works during the meeting of the Institution of Gas Engineers at Norwich (in the June of 1909), they were all keen to have another look round, because Mr. Glover has the reputation of being one of those men who are constantly making little improvements here and there, even when they cannot make any big changes; and it is the sum-total of these minor improvements which may mean so much to every gas engineer. For illustrated descriptions of the Norwich works, readers are referred to the "JOURNAL" for Sept. 19 and 26, 1905, June 22, 1909, and Aug. 22, 1911. The chambers which were in use at the time of the big meeting in 1909 have been superseded by large section horizontal through ⏢-retorts, 21 feet in length, in settings of ten, with De Brouwer charging and discharging machinery. The largest of these are 24 in. by 18 in., taking 17 cwt. charges, worked off in 12 hours. It is found, when they are fully charged, that they produce the same quality of coke as the chambers. Silica combustion chambers are used, and a feature of the retorts which was remarked upon by several members was that they had square corners—no doubt with a view to increased strength. The heating appeared to be even, and the charges well burnt off. One of the retorts, which had been in use for some 1500 days, was critically examined, and pronounced to be in excellent condition. Other noticeable features of the works were the coal and coke handling plants. The coal barges are unloaded by a continuous bucket elevator which is lowered gradually into the coal; and the latter is taken into the store by belt conveyors, and dropped where required. In this way the coal reaches the store without being touched by hand. It appears to be an excellent arrangement, but apparently cannot be extended beyond application to fine coal. The power is supplied by a gas-engine. The coke plant is situated next to the retort-house, so that the coke is raised straight to the screens, stored under cover, and loaded into carts or motors for sale by means of shoots which are opened or closed by a hand lever. Mention must also be made of the tar-

distilling plant, where it is hoped shortly to make the material for the road surfacing process already described. Up to the present, the works have not been entirely successful in producing the exact quality required, and supplies have been drawn from the Yarmouth products works of the British Gas Company. An intimate mixture of pitch with portland cement filling, in exact proportions and under certain conditions of temperature, is required, and its production is not a simple matter. The impression left by the works was that, even if they are not a model of all that is most modern in gas manufacture, they are at any rate a model of how works should be kept. The thanks of the members are due to Mr. V. E. Harston, Mr. Glover's Assistant-Engineer, for the way in which he assisted in guiding the party round the works.

The Luncheon.

The inspection finished, the members repaired to the Maid's Head Hotel, where they were the guests of the British Gaslight Company, with Mr. Glover in the chair. They were awaited at the hotel by a larger detachment, which had arrived by a later train; so that, in all, the guests at lunch numbered over 50. The Lord Mayor of the city, Mr. J. A. Porter, and several members and officials of the Corporation were also present. During the proceedings a quartette party sang some charming glees. After the loyal toast had been honoured,

The Chairman proposed the toast of the "Corporation of Norwich."

The Lord Mayor replied, and said the Corporation of Norwich had been trying to light the streets with electricity. It was strange that, since they started their own electric plant, the citizens of Norwich had been on more friendly terms with the Gas Company than they were before. Years ago the Gas Company was not looked upon with favour by the citizens of Norwich. The coming of electricity and the coming of Mr. Glover coincided, and his hearers could put down the better relations now existing to whichever cause they liked. He himself did not put it down to electricity. Mr. Glover had always endeavoured to make the use of gas as popular as possible. He had always been up to date, if not a little ahead of the times, and this policy had been much appreciated by the citizens of Norwich.

Mr. W. E. Price, of Hampton Wick, in his most humorous vein, proposed the "City and Trade of Norwich," and Mr. G. H. Morse and Mr. A. G. Howlett, members of the Corporation, responded.

Mr. H. J. Copeman, a former Mayor of Norwich, proposed "The Southern District Association of Gas Engineers and Managers." He said the gas industry was stated by some to be a declining one, but there was not much evidence of it in this gathering. He had known Mr. Glover intimately ever since that gentleman came to Norwich, and a more genial and gentlemanly man he had never met. He would imagine Mr. Glover was one of the ablest gas managers in the country. Since Mr. Glover came to Norwich he had had difficulties to contend with; one of them being the competition of the electricity concern. But he had risen to the occasion; and although he had had to retreat from the streets, he had invaded private houses. Since he (Mr. Copeman) had had electricity installed in his house, he had spent far more on gas than he did before. [Laughter.] He cooked by gas, he heated his conservatory by gas, and he warmed several of his rooms by gas. Another difficulty Mr. Glover had had to contend with was the flood of 1912. But on that occasion, although the electricity works had to stop, the gas-works were more fortunate.

Mr. Glover, in responding, expressed regret at the absence of the Chairman of the Company, who, he said, would be delighted to know that the relations between the Company and the City Authorities were so cordial and hearty. He had always striven to give Norwich the best gas supply possible in local circumstances. Norwich was a long way from the coal-fields, but the Company had very considerably improved the methods of delivery of coal. They had reduced working costs very considerably, and had lowered the selling price of gas. They gave a constant supply and consistent quality as far as possible. They lived on good terms with their competitors, and, as the Chairman of the electricity undertaking said to him the other day, they had done each other good. He told the Chairman of the electricity undertaking that he made it rather hard for the Company sometimes, and the Chairman replied that, as he saw their balance-sheets, he was not sorry for them. [Laughter.] In spite of the coming of electricity, he believed that gas had still a place in private and public life. Over 22,000 small houses in Norwich were supplied with gas cooking stoves, and the Company had 29,000 consumers. A friend from Lancashire a short time ago remarked upon the clearness of the atmosphere of Norwich, and attributed it to the fact that the factories were driven by electricity and the houses were supplied with gas cooking stoves. The factories knew the value of gas for power, which was supplied to some of them at 1s. 9d. per 1000 cubic feet. Twelve years ago the price of gas in Norwich was 3s. 6d. per 1000 cubic feet to everybody.

Mr. W. M. Mason, the Secretary of the British Commercial Gas Association, proposed "The British Gaslight Company, Limited." He said the Company represented all that was best in the gas industry. Its motto was progress and the service of the people. Gas was as much a necessity in the homes of the people as water, and much more than electricity. The Board of Trade statistics, referring only to statutory undertakings, showed that the sale of gas in ten years had increased by 45 thousand million cubic feet, while the consumers showed an increase of over three millions in the same period.

Mr. G. Lowe, who has recently been appointed Chief Clerk of the Norwich station of the Company, briefly responded.

Reception at the Bishop Bridge Works.

The luncheon concluded, a move was made to the Cathedral. This interesting and magnificent structure was inspected under the guidance of the Very Rev. the Dean of Norwich, who, by his capacity as a cicerone, his evident love of the place, and his genial and entertaining personality, won the hearts of all present. A short walk then brought the members to the Bishop Bridge Gas-Works, where they had a very hearty reception from Mrs. Glover, and were conducted into the meter-house for tea. It would be a beautiful meter-house at the best of times, but, disguised as it was in carpets and flags, it looked more like a large social hall. Even the exhauster, which is in the same room, was so quiet as to be almost imperceptible. This exhauster draws all the gas from the other works, where it is manufactured, to the Bishop Bridge works, where it is purified, stored, and distributed. As Mr. Glover informed the members, he is in the extraordinary position of working his purification at a profit. He has two sets of four purifiers each for coal gas, and one set for water gas. He works on the backward rotation system, passing the gas downwards through one layer only of oxide, 5 feet deep. The spent oxide, after treatment, is returned to him to be used again; only small quantities of fresh being added from time to time. An addition of 2 per cent. of air is made to the gas, and the sulphur impurities sent out with the gas do not exceed 24 grains per 100 cubic feet.

After tea, Mr. Glover explained the circumstances which led up to this division of labour between the two works. Mr. H. O. Carr (Wandsworth) then thanked Mr. and Mrs. Thomas Glover for their kind hospitality, which brought a highly interesting and successful day to such a pleasant conclusion. Mrs. Glover responded. It may be mentioned, for the benefit of those members of the Association who were unable to be present, that Mr. Glover, in his capacity as President, appealed to the members to come forward with subjects for papers for the autumn meeting, as he was sure they would all prefer, if possible, to have papers from their own members, without going outside the Association. An inspection of the purifying plant exhausted the remainder of the time, and this concluded a successful and instructive visit.

ILLUMINATING ENGINEERING SOCIETY.

The Annual Business Meeting of the Society was held last Thursday at the Royal Society of Arts. Professor Silvanus P. Thompson, D.Sc., F.R.S., &c., the President, was in the chair. Among those present was Mr. Edward Allen, the President of the Institution of Gas Engineers. The Hon. Secretary (Mr. Leon Gaster) gave a digest of the annual report of the Council, a complete copy of which we shall have in due course, and then further reference may be made to it. Meantime, it may be stated that among its items was the fact that the membership now stands at about 470, although the Society only started a little over four years ago with thirty members. The report also referred with regret to the retirement from the office of President of Professor Thompson, who has filled it from the inception of the Society. There was gratification in recording that the Council had succeeded in securing Sir William Bennett as the successor of the distinguished retiring President. Satisfaction was expressed by Mr. Gaster in being able to announce that, during the Society's existence, some 1500 visitors had attended the various meetings. On the motion of Mr. F. W. Goodenough, seconded by Mr. Allen, the report was adopted. Then came a vote of thanks to the President for his services in the chair during the past four sessions. Its proposing was in the hands of Mr. Goodenough, who is Chairman of the Council; and his words were highly eulogistic of the services rendered to the Society by Professor Thompson. Mr. R. J. Wallis-Jones seconded the motion, which was carried by acclammation. Professor Thompson, who is always modest in regard to personal laudation, disclaimed a large part of the merit showered upon him, but nevertheless heartily thanked the members, and expressed the hope that, under the new President, the Society would continue its prosperous and beneficent career. Then the Council and officers were thanked—the proposer being Mr. W. J. Liberty, and the seconder Mr. Campbell. Mr. Goodenough responded on behalf of the Council, and Mr. Gaster for the officers. Then the generosity to the Society of the Council of the Royal Society of Arts was acknowledged—the President moving the resolution and Mr. Haydn Harrison seconding it. At the close of the business meeting Mr. A. P. Trotter read an important paper on photometrical units and nomenclature, which gave rise to an equally important discussion. Extracts from the paper and some points from the long discussion appear in other columns.

Midland Association of Gas Managers.—The Spring Meeting of the Association will be held at Mansfield to-morrow. According to the programme of arrangements, the members will reach the town about eleven o'clock, and will be welcomed, on behalf of the Corporation, by his Worship the Mayor (Alderman T. Taylor, J.P.) and the Chairman of the Gas Committee (Mr. T. Smith). A short business meeting will be held, and at its close the members will inspect the gas and electricity works (the former under the guidance of Mr. W. J. Rendell-Baker, the Gas and Water Engineer and Manager). Subsequently, they will partake of luncheon at the Swan Hotel, on the invitation of the Mayor and Corporation of Mansfield. In the afternoon there will be a drive through the Dukeries and a visit to Welbeck Abbey, by permission of his Grace the Duke of Portland, K.G. On returning to Mansfield tea will be served at the Swan Hotel, and the members will then leave for their destinations.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Manchester.

THE One-Hundred and Seventieth Quarterly Meeting was held in the Town Hall, Manchester, on Saturday, under the presidency of Mr. J. G. NEWBIGGING; there being a "record" attendance of members.

AT THE ROCHDALE ROAD WORKS.

By the kind permission of the Chairman (Mr. W. Kay, J.P.) and the members of the Gas Committee of the Corporation, over a hundred members visited the Rochdale Road Gas-Works, and inspected the 4 million cubic feet per diem Glover-West installation of vertical retorts now nearing completion, and also the various retort charging and discharging machines in operation at these works. Special cars were provided by the Committee to enable the visitors to reach the works, where they were heartily welcomed by Mr. T. Cook (a member of the Gas Committee), and the principal officials of the department, including Mr. G. W. Tooley (Manager of the Rochdale Road works), Mr. Buckley (Chemist at the works), Mr. J. R. Hill (Manager of the Bradford Road works), Mr. A. L. Holton (Superintendent of the Bradford Road works), Mr. J. Taylor (Deputy-Manager of the Bradford Road works), Mr. E. Williams (Chief Chemist), Mr. A. Massey (Manager of the Droylsden works), Mr. W. H. Cummins (Chief Draughtsman), and others. A description of the carbonizing plant at the Rochdale Road Gas-Works will be found on p. 561. About an hour-and-a-quarter was profitably spent in the works, under the pilotage of these gentlemen, after which the visitors returned to the Town Hall, where they were entertained at luncheon, at which function the Rt. Hon. the LORD MAYOR (Alderman Daniel M'Cabe, J.P.) was present, but had to leave before it concluded, in order to attend another meeting.

THE LUNCHEON.

Luncheon was served to about 150 guests in the Banqueting Hall, Mr. Kay, who presided, having, as his principal supporters, Mr. J. G. Newbigging (Chief Engineer to the Manchester Corporation Gas Department, and President of the Manchester District Institution of Gas Engineers), Mr. E. A. Harman, of Huddersfield (the Senior Vice-President), Mr. Edward Allen, of Liverpool (President of the Institution of Gas Engineers), and several Past-Presidents of the Manchester Institution. The toast list was brief. There was, however, an innovation in the terms in which the Loyal Toast was proposed; the Chairman introducing the toast as that of "His Majesty the King, Duke of Lancaster, and Lord of the Manor of Salford."

THE VALUE OF TECHNICAL INSTITUTIONS.

The CHAIRMAN, in proposing "The Manchester District Institution of Gas Engineers," remarked that he desired to say with what pleasure the Manchester Gas Committee welcomed the Institution that day. They, as a Committee, recognized that by institutions of this description, and by gatherings such as this, the very best results must accrue to everybody in the industry. Such gatherings gave them opportunities for criticizing and grumbling; for it was by controversy and competition that success was gained. He was reminded of his early days, when he was Deputy-Chairman of the Electricity Committee; and he still thought competition with electricity was, on the whole, healthy. The Gas Committee tendered to them a hearty welcome, because they recognized that they had in their service most admirable officials who were members of the Institution. Mr. Newbigging, their Chief Engineer, whose name he desired to couple with the toast, had made a special study of the vertical retort method of carbonizing; and he (Mr. Kay) was satisfied that at the moment Manchester had adopted the most up-to-date method in gas manufacture. It behoved the Corporation to consider the neighbours in the districts in which the gas-works were situated; and he was sure that the vertical retort system would lead to the neighbourhoods being as pleasant as any other in city. Not only was this method of carbonization less objectionable to those in the vicinity, but the vertical retort system of continuous carbonization was destined to play an important part in the question of the calorific standard of gas, with the result that the quality of the commodity, both for lighting and heating purposes, would be much improved. There were no naphthalene troubles with the vertical system; and no complaints of stopped-up pipes, &c.—a most important factor. Referring to the question of rate-aiding out of gas profits, he said the "two things did not seem to fit." The consumer could not contribute very largely to the relief of rates, and at the same time have a cheap supply of gas.

The PRESIDENT, in acknowledgment, said he was sure the members joined with him in thanking the Gas Committee for their hospitality, and Mr. Kay for the kind terms in which he had alluded to the work of the Institution. In a very short time—six years, to be precise—the Manchester Institution would celebrate its jubilee. He ventured to think that during the 44 years of its existence they, as members, had reason to be proud that they had served the gas industry in a very able manner. That wonderful organization, the British Commercial Gas Association, owed its origin to certain members of their Institution; and another matter they had taken up with vigour was the question of the education of gas-fitters—a most important matter to men who daily came into contact with their gas consumers. More recently still they were indebted to another member, Mr. George Stevenson, of Long Eaton, for having, mainly by his exertions, secured a very important judgment in the Chancery Division of the High Court of Justice against the preferential treatment which had been meted out by the Electrical Department to the detriment of gas undertakings. He (the President) was not there to discuss the matter that day; but he rather desired to point the moral of it—that it was very unwise on the part of both gas and electrical undertakings to have this cut-throat competition. He sometimes thought that municipalities did not always appreciate the fact that in their gas and electrical undertakings they had machinery capable of coping satisfactorily with the smoke problem, and that it would be more profitable to reduce the price of gas to the consumer. Thanks to the fact that in Mr. Kay the department had a very progressive Chairman, they had made great headway in the provision of gas for purposes other than lighting. The total consumption for the quarter ending March last was close upon 6000 million cubic feet; and of this nearly 25 per cent. had been used for purposes other than lighting, at an average price of 1s. 11½d. per 1000 cubic feet. If the Gas Department had been relieved of their contribution of £50,000 to the rates, this gas could easily have been sold at 1s. 9d.; and at lower prices he was sure the consumption of gas in Manchester could be trebled or quadrupled.

A MEETING HALL FOR ENGINEERS.

A question he desired to ask was, What should Manchester do for an Institution like theirs? After the cotton and allied industries, he believed he was correct in saying that the engineering industry was the most important in the city. The more the engineering institutions were encouraged, the better for the city. He thought the Corporation could not do better than set aside on the land in Piccadilly, where it was proposed to erect an art gallery and library, some space for a hall for gatherings of such institutions, and a reference library for the exclusive use of technical men.

Mr. E. A. HARMAN next submitted the "Chairman and Members of the Manchester Corporation Gas Committee." He did so in a speech which created much amusement. He assured the Chairman that the members of the Institution deeply appreciated the opportunity of inspecting the new installation at the Rochdale Road works. They were proud to have Mr. Newbigging as their President.

The CHAIRMAN, in responding, assured the members that the progressive policy would continue in regard to cheapening the supply of gas to the consumer, not only of the better-class, but of the working-class; and in this direction there was a field to be cultivated by giving the people a ready supply of hot water. This question presented no difficulty so far as he could see; and it would make a deal of difference in the homes of the working-classes in the future. He appreciated their kindness and presence in their midst that day.

THE VISITORS.

Alderman BOWES, J.P. (the Chairman of the Tramways Committee), proposed the health of "The Visitors" in a felicitous speech. He remarked that, as one of the oldest members of the Gas Committee, he cordially agreed with Mr. Kay's statement regarding the progressive policy. Manchester was fortunate in having such a man as Mr. Kay to preside over its great undertaking. They were also equally proud of their Chief Engineer, Mr. Newbigging. [Applause.] To him, Mr. Newbigging's conspicuous success was very gratifying, because he had the honour of nominating him for the position, and he had never felt ashamed of the resolution. "In fact," he added, "it is one of the very best resolutions I have ever moved in the Manchester Corporation." With the toast, he desired to couple the names of Alderman Wilde, J.P. (Mayor of Oldham, and Chairman of the Corporation Gas Committee) and Alderman Phillips, J.P. (the Chairman of the Salford Gas Committee).

Alderman WILDE, in responding, said his fourteen years' experience of gas matters, and especially among gas engineers, led him to believe that corporations and companies were quite safe in leaving the industry in their hands. The advancement of gas matters in the last ten or twelve years had been remarkable; and improvements were still going on. He cordially agreed with Mr. Kay when he said that a good deal remained to be done in regard to the introduction of gas appliances for the household. There was plenty of scope in this field for the further development of the industry. Like Manchester, Oldham had an electrical department; but there was plenty of room for both Manchester and Oldham to do their best to clarify and rarefy the atmospheres in their respective localities, by encouraging the use of gas appliances in the household on all possible occasions.

Alderman PHILLIPS said he remembered the Institution visiting Salford many years ago, when his Committee had the pleasure of entertaining them. He was glad to see how the Institution had grown since those days, and that instead of losing anything it had gained considerably, both in strength and importance. He cordially agreed with the other speakers that there was plenty of room for development yet, and particularly by the introduction of additional gas appliances. The work that gas had to do, not only for their own particular community, but for the whole of the country, was, in fact, only just beginning; and the future was in the hands of the engineers present to-day. Some people had told them that Committees ought not to make a profit on gas; but he did not believe it. The question of smoke or no smoke did not entirely depend on making profits or not out of gas. He instanced, in support of this statement, Sheffield and Widnes, where the price of gas was low, and where there certainly was a smoke problem. He thought it was largely a matter of converting and habituating the people to the use of gas and to the use of coke. Once the people were convinced regarding the efficacy of using gas for all purposes—and English people took a great deal of convincing—and more accustomed to better methods, it would not then absolutely depend upon the price of gas. They, as gas committees, could do a great deal to popularize gas independently of the question of price; and he was delighted to hear and see the progressive spirit which prevailed in the Manchester Institution. Referring to the absence of Sir Chas. Behrens, Sir Walter Royse, and

Alderman Miles (of Bolton), he said he was sure the members regretted that these gentlemen had been prevented from attending. The visitors felt a great compliment had been paid by inviting them to be present on so pleasant an occasion.

THE BUSINESS MEETING.

The business meeting was subsequently held in the Lord Mayor's Parlour—the PRESIDENT in the chair. He was supported by Mr. Edward Allen, Mr. E. A. Harman, and Mr. G. S. Frith, of Runcorn, the Hon. Secretary.

The PRESIDENT, in opening the proceedings, said it afforded him much pleasure to introduce their new Hon. Secretary to the members. Mr. Frith followed a long line of good Secretaries, and he hoped that for a long time they would have his services in this capacity. He was sure they had made a good choice.

The minutes of the last meeting were unanimously agreed to.

LETTERS OF APOLOGY.

Letters of apology for non-attendance were read from Mr. Thomas Waddom (the President of the North of England Gas Managers' Association), Mr. Thomas Glover (the President of the Southern District Association), Mr. Thomas Newbigging, D.Sc., and others. Mr. Frith added that he regretted to have to announce that Mr. Thomas Newbigging's letter conveyed an intimation that he was not feeling very well at present.

Mr. HARMAN said he would like to take the opportunity to propose that the meeting send a message of sympathy to Mr. Newbigging, expressing their sincere regret at his enforced absence that afternoon, and their good wishes for his speedy recovery. He suggested that a telegram in these terms be despatched to their distinguished colleague forthwith.

Mr. J. C. BELTON (Chester) cordially seconded, and said that the members not only desired Mr. Newbigging's speedy recovery, but his re-appearance in their midst.

A telegram was despatched in the following terms:

> At a meeting of the Manchester District Institution of Gas Engineers to-day, sincere regret was expressed at your absence, and heartiest good wishes for your speedy recovery.

To this, the following reply was received:

> To the Secretary of the Manchester Institution of Gas Engineers, Town Hall.—Very many thanks for telegram. I am a little better to-day. I hope you are having a pleasant and profitable meeting.—Thos. Newbigging.

The HON. SECRETARY also read a letter from Mrs. Whatmough, of Heywood, expressing her thanks to the members for the ring given to her by them in acknowledgment of her husband's services as Hon. Secretary of the Institution for the past six years. The letter was ordered to be entered on the minutes.

DEPARTED MEMBERS.

The PRESIDENT said he had to announce with deep regret that they had lost two members by death since the last meeting—Mr. William Severs, late of Wilmslow, and Mr. S. S. Mellor, of Northwich, the last-named of whom was for fourteen years Hon. Secretary of the Institution, and did very good work in this position. Resolutions of sympathy had been passed by the Committee and duly forwarded to the relatives. He asked the members to rise in their places as a mark of respect to their late colleagues.

This was done in silence.

NEW MEMBERS.

The PRESIDENT introduced the following gentlemen as members of the Institution: Mr. Isaac Carr, M.Inst.C.E., of Widnes; Mr. W. M. Carr, of Ormskirk; Mr. W. J. Fletcher, of Carnforth; Mr. Walter Hole, of Leeds; Mr. Thos. H. Nield, of Hollinwood; and Mr. Robt. B. Braddock, of Radcliffe.

Alluding to Mr. Isaac Carr, the President said he was particularly pleased to see his name at the head of the list. He reminded the members that in 1896, Mr. Carr occupied the position of President of the Manchester Institution. Unfortunately, however, he left them two or three years ago; but they were very glad indeed that he had now returned. They would look forward to receiving the benefit of his experience and advice at their future meetings. He was also glad to see the name of Mr. Carr's son on the list.

PAPER ON STOKING MACHINERY.

Mr. W. M. CARR (Ormskirk) then read his paper on "The Application of Stoking Machinery in Small Gas-Works," which, with some of the remarks thereon made by various members, will be found on p. 570.

THANKS TO THE GAS COMMITTEE.

Mr. EDWARD ALLEN proposed a hearty vote of thanks to Mr. Councillor Kay, J.P., and the members of the Gas Committee for their kindness.

Mr. E. A. HARMAN seconded, and alluded to the warmth of the reception accorded to the visitors at the Rochdale Road works by Mr. Councillor Cook earlier in the day. The Chairman of the Rochdale Road works had certainly gone out of his way to make everything comfortable. He hoped that Mr. Cook would accept their sincere gratitude.

Mr. COOK briefly acknowledged the vote, and thanked the members for their appreciation.

Tea was afterwards partaken of, in the course of which arrived the telegram [given above] from Mr. Thomas Newbigging, which was read to the members by the Hon. Secretary.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Annual Meeting.

The Annual General Business Meeting of the London and Southern District Junior Gas Association was held on Friday at the Westminster Technical Institute—the PRESIDENT (Mr. S. A. Carpenter) in the chair.

ELECTION OF OFFICERS.

The balance-sheet was adopted, and the following were elected as Officers and Council for 1914-15:

President.—Mr. J. Hewett (South Metropolitan Gas Company).
Senior Vice-President.—Mr. Ernest Scears (Hampton Court Gas Company).
Junior Vice-President.—Mr. S. B. Chandler (South Suburban Gas Company).
Council.—Messrs. W. E. Brown, G. F. Cox, D. C. Cross, F. C. Briggs, F. J. Pearce, E. G. Stewart, W. A. Vanner, G. Winslow.
Ex-Officio Members.—Messrs. D. J. Winslow and S. A. Carpenter.
Hon. Secretary.—Mr. A. R. Griggs (South Suburban Gas Company).
Hon. Treasurer.—Mr. F. A. Frost (South Metropolitan Gas Company).
Hon. Auditor.—Mr. E. G. Merry (Gas Light and Coke Company).

THE WORK OF THE ASSOCIATION.

The PRESIDENT, after stating that the membership of the Association was now 171, against 168 last year, made some remarks on the work of the Association, which had now completed its eleventh session. He said they had had some most successful meetings; the addresses by Mr. Milne Watson and Mr. Charles Carpenter, each unique in its own particular way, were given to very large audiences; and it was most encouraging to them as a Junior Association that gentlemen holding such high positions in the industry should so honour them. An interesting feature of the session was the National Gas Congress and Exhibition, which attracted crowds of consumers, and without doubt did the gas industry a vast amount of good in showing the very many ways in which gas could be used with advantage and profit. The joint visit of the English and Scottish Associations in October drew members from all parts of Great Britain. Coming to the technical papers, that by Mr. J. G. Clark on "Eddies" was an excellent example of research work which had a direct bearing on everyday practice. The paper by Mr. F. S. Larkin on "Gas-Stove Construction" introduced new and important points, and showed them that the gas-cooker, which had been rather neglected of late years, was now receiving the attention it deserved. They had sometimes been accused of neglecting the manufacturing side in their programmes; but this reproach could not be aimed at them this year, in view of Mr. F. Pearce's paper on the "Reconstruction of a Retort-House," and also the lecture by Mr. Stanley Cooper on "Coke-Oven Practice." The last ordinary meeting of the session was easily a record in the way of attendance. He referred, of course, to the paper by Mr. George Keith, on the "Silica Lamp." There were about 250 present. This paper would be a most valuable addition to the "Transactions." An important feature this session was the series of special lectures on "Refractory Materials" and "Furnace Heating," by Dr. R. Lessing and Mr. L. F. Tooth, which were so well appreciated that the Council were arranging for a further series next session. There was still one more fixture on the programme, which should prove a very pleasant outing—the visit to the Davis Gas-Stove Company's works at Luton.

ALTERATION OF RULES.

The NEW PRESIDENT (Mr. J. Hewett) then took the chair, and Rules 4 and 7 were altered. Rule 7 relates to the conduct of business; and Rule 4 as altered reads:—

> Rule 4.—Qualification. Membership is open to persons engaged in gas-works, coke-oven works, or any works dealing with the working-up of gas-works residual products, under the control of a gas company or local authority, or otherwise associated with gas manufacture or supply, but who is not engaged in the manufacture of material or appliances used in gas manufacture or supply.

VOTES OF THANKS.

The Officers and Council and the Hon. Auditor were thanked for their services, and

Mr. D. J. WINSLOW then proposed: "That this annual general meeting of the London and Southern District Junior Gas Association places upon record its most sincere appreciation and thanks to Mr. S. A. Carpenter for his valuable services in conducting the affairs of the Association as President for the year now completed, and for the untiring energy and enthusiasm he has displayed at all times—with especial mention of the office of

Honorary Secretary and Treasurer—by which he considerably assisted the furtherance of the usefulness of the Association both to the members and the industry, and wishes him every success in his future career."

Mr. E. SCEARS seconded the resolution, which the meeting decided should be suitably emblazoned and framed and presented to the retiring President.

Mr. CARPENTER thanked the meeting heartily for the very kind resolution.

Mr. J. HEWETT then proposed, and Mr. F. A. FROST seconded, the following resolution: "This annual general meeting of the London and Southern District Junior Gas Association hereby places upon record its hearty appreciation of the incalculable services rendered by Mr. Ernest Scears during the years he has held the office of Honorary Secretary, and welcomes this opportunity of tendering to him its sincere thanks for the untiring energy and valuable time so freely given in the interests of the Association, and which have contributed in so great a measure to its success."

Mr. SCEARS suitably responded.

Afterwards a demonstration was given of the "Pulmotor" automatic resuscitator, for use in case of asphyxiation, drowning, poisoning, electric shock, &c. Mr. Harry L. B. Crouch, as representing the Pulmotor Company, explained in detail the apparatus, stating that it was the only machine that introduced oxygen into the human system under pressure, the mechanical action of which corresponded to the action of breathing, and adapted itself to the size and capacity of the lungs, whether of an adult or child. The lungs governed the working of the machine; and this made it impossible to over-inflate. It was, in fact, human breathing by machinery. The working pressure was 8 inches water-gauge and 45 per cent. of oxygen was used. Mr. Crouch was thanked for giving the meeting the demonstration.

MIDLAND JUNIOR GAS ASSOCIATION.

Annual General Meeting.

The Annual General Meeting of the Association was held last Saturday afternoon, at the City of Birmingham Municipal Technical School, Suffolk Street—Mr. W. H. JOHNS, of West Bromwich, the President, in the chair.

THE DEATH OF MR. MEIKLEJOHN.

The PRESIDENT, at the opening of the proceedings, said this was the first business meeting they had held since the death of Mr. Charles Meiklejohn, of Rugby; and he would ask the members to rise in their places and show their sympathy with the relatives in the irreparable loss they had sustained. The Association really owed its birth to the efforts of Mr. Meiklejohn, in conjunction with Mr. Thomas Berridge, of Leamington. He took a very great interest in the work of the Association when he was Hon. Secretary of the Midland Senior Association.

The proposal of the President was adopted, by the members quietly rising.

SUGGESTED ALTERATION OF RULES.

The HON. SECRETARY (Mr. W. J. Pickering) said he had received a proposal that Rule No. 7 should be altered, so as to increase the number of members of Council, and insert a clause ensuring that the distribution and supply side should have a greater proportional representation.

Mr. G. C. PEARSON (Birmingham) pointed out, on behalf of the Council, that the Association was formed in the first instance by the manufacturing side. The distribution department had, however, grown greatly in strength; and they were all very grateful indeed for the interest they were taking in the work of the Association. If they would send in more papers dealing with distribution matters, the Council would be only too glad to receive them.

The PRESIDENT thought the Council was quite large enough at present. At this meeting, the distribution side would have an opportunity of putting one of their number into office.

The view thus expressed was adopted by the meeting.

THE ANNUAL REPORT AND ACCOUNTS.

The HON. SECRETARY then read the annual report, which congratulated the members upon an interesting session. The number of ordinary members on the books at the commencement of the session was 191, and had now increased to 209. Indebtedness was expressed to the President for his address and for the manner in which he had carried out the duties of the chair; to the readers of papers; to the directors of the various undertakings visited, for their unfailing courtesy and hospitality; and to the Committee of the Technical School for granting the use of a room. The following advancements of members during the session were recorded: Mr. W. H. Johns from Birmingham to Engineer and Manager at West Bromwich; Mr. C. C. Barber from Adderley Street to Works Superintendent at Saltley; Mr. R. J. Rogers appointed Assistant Fittings Superintendent at Birmingham; Mr. R. A. S. Browning from Saltley to Works Superintendent at Adderley Street; Mr. A. Hancox from Malvern to Works Superintendent at Mansfield; Mr. T. H. Poulson from Nelson to Stafford; Mr. S. H. Wallis Boyns from Smethwick to Oxford; Mr. W. H. Cattell from Birmingham to Show-Room Superintendent at Swansea; Mr. A. E. Cutler from Banbury to Cleethorpes; and Mr. F. C. Robinson from Birmingham to Works Chemist to the Preston Gas Company.

Mr. B. SKIDMORE (Smethwick) proposed that the report be adopted.

Mr. B. J. BELL (Birmingham) seconded, and remarked that the report was one of which they might justly feel proud. It was not often an opportunity presented itself of mentioning the name of the Secretary; but he thought that as Mr. Pickering had done such valuable work, they could not do less than express their indebtedness to him.

The PRESIDENT, before putting the resolution to the meeting, added his thanks to the Secretary for the excellent way in which he had carried on the work of the Association and assisted him (the President). It had, he said, been a very busy year for Mr. Pickering. The Association was rapidly increasing in numbers; and the secretarial work, of course, grew also.

The HON. TREASURER (Mr. H. E. STONE, of Nechells) submitted the accounts, explaining the various items. He said the members had not taken up the copies of the "Transactions" in the way they should do; and there were still a number on hand which it was hoped members would assist in disposing of.

Both documents were adopted without discussion.

ELECTION OF OFFICERS.

Thereafter Mr. B. Skidmore, who is connected with the distribution department at Smethwick, was appointed Junior Vice-President; the Secretary and Treasurer were re-elected; the Hon. Auditor (Mr. J. H. Hardy, of Coventry) was thanked for his services; and the work of the members of the Council was similarly acknowledged. Mr. Harold Jones, of Stourbridge, had been co-opted on the Council, in place of Mr. G. F. Twigg, who had left Derby to go to Jersey; and this step was ratified by the meeting. In place of Mr. Skidmore, on the Council, the recommendation was adopted to elect for twelve months Mr. T. H. Poulson, of Stafford. To fill vacancies on the Council, Mr. R. G. Marsh was elected as a Birmingham member, and Mr. S. A. Wikner (of Messrs. Hardman's Limited) as a district member—both of them to retire in 1917.

HIGH-PRESSURE GAS SUPPLY AND REINFORCEMENT, AND LOW-PRESSURE STANDARDIZATION.

Mr. B. F. BOTWOOD, of Birmingham, afterwards read a paper entitled "High-Pressure Gas Supply and Reinforcement, and Low-Pressure Standardization." This was illustrated by lantern slides; and the author also exhibited a number of specimens of jointing and materials, &c. The paper, with a report of the discussion, will be found on page 580.

PRODUCTION OF NITROGEN OXIDES.

The Badische Anilin und Soda-Fabrik have taken out a patent for France [No. 464,237] for a process for the production of nitrogen oxides by the oxidation of ammonia in the presence of catalyzers.

The patentees remark that when ammonia is transformed into nitrogen oxides by oxidation by means of oxygen or atmospheric air in presence of catalyzers of the platinum group, it is observed that the catalytic activity of the latter decreases more or less rapidly when the gas, once purified and freed from dust, comes into contact, before reaching the catalyzer, with pipes or apparatus made of iron or copper. According to the invention, it has been found that this inconvenience can be avoided by subjecting the gaseous mixture, before it enters the contact chamber, to fresh mechanical purification. Pulverulent impurities produced in the gas by the materials of which the conduits, &c., are made, and small quantities of which suffice to paralyze the activity of the catalyzer, are thus eliminated.

Another method of maintaining a good catalytic activity indefinitely during permanent working consists in using for the conduits and parts of the apparatus with which the gas can come into contact before they reach the catalyzer, metals which do not produce dust in the gas. Some answering the purpose are nickel, rich nickel alloys, &c. In this case, it will be necessary to take care that the gaseous mixture or its constituents (especially air for oxidation) is free from dust to start with.

Iowa District Gas Association.—The tenth annual meeting of this Association is being held this week in Davenport (Ia.) Papers on the following subjects will be submitted to the members for discussion: "Tar," by Mr. Alfred Hansen; "The Store-Room," by Mr. George G. Kuhn; "Domestic Appliances," by Mr. C. W. Lockwood; "The Elements of Gas-Rate Making," by Mr. Henry I. Lea; "Some Distribution Experiences," by Mr. W. H. Merritt; and "Circular 32 and the Report of the Committee on Thermal Value and Candle Power made to the New York State Public Service Commission," by Mr. Austin Bush. In addition, the Manufacturing, Distribution, Construction, New Business, and Public Relations Committees will present reports. One day during the meeting will be spent on board a Mississippi steamer.

THE APPLICATION OF STOKING MACHINERY IN SMALL GAS-WORKS.

By W. M. Carr, of Ormskirk.

[Prepared for the Meeting of the Manchester District Institution of Gas Engineers, on Saturday, May 23.]

The installation of machinery in small gas-works is now becoming general practice, and it can be profitably adopted in works carbonizing 5000 tons of coal per annum. In dealing with this subject, I propose to describe generally the plant laid down at the Ormskirk Gas-Works, and the considerations which led to its adoption. The principal factor governing the selection of carbonizing plant is capital cost, especially in the case of small undertakings where the margin of saving is necessarily small, and there is danger of the interest on the expenditure minimizing the benefit of such saving.

The scheme for new carbonizing plant was under consideration in the early part of 1912, at which time the maximum day's make was 259,000 cubic feet, and the minimum 90,000 cubic feet; the annual make for 1911 being 50 millions. There was the prospect of a rapid increase in the output of gas; and it was decided to provide carbonizing plant with a capacity of 400,000 cubic feet per diem, with provision in the retort-house space for extension to 500,000 cubic feet.

The plant in existence at this time with hand stoking was in a very poor order, and the working results correspondingly poor; so that it would have been unfair to have taken these results as a basis for estimating the saving that might be made by the installation of modern plant. The cost of an up-to-date house of horizontals for hand stoking was estimated at £4500 complete; and the extra cost of erecting a stage-floor house, and equipping it with coal-handling plant and stoking machinery, was £3000. It was therefore necessary that an annual saving of not less than £600 per annum should be effected by the stoking machinery, in order to give a fair return on the extra capital expenditure after allowing for interest and maintenance.

The question of installing vertical retorts was gone into. At that time, however the extra cost of a vertical house would have been some £2500 more than a horizontal house equipped with stoking machinery; and it was felt that there was not sufficient justification to admit of the extra capital expenditure, especially as it was difficult to appreciate how a further saving of £300 per annum or 7·2d. per ton of coal could be affected. The figures of comparison were as follows:

Estimated Carbonizing Results on Annual Make of 80 Million Cubic Feet.

—	Horizontal Retorts. Hand Stoking.	Horizontal Retorts. Machine Stoking	Vertical Retorts.
Gas made per ton of coal, aver. quality 600 B.Th.U., 17-candle power No. 2 Met.	10,500 cu. ft.	12,000 cu. ft.	12,000 cu. ft.
Workmen required per shift of 12 hours for all labour from coal store to coke in yard, average	5	2½	2
Surplus coke available for sale per ton of coal . .	10 cwt.	11·5 cwt.	10·5 cwt.
Capital cost.	£4500	£7500	£10,000

Costs per 1000 Cubic Feet.

Coal at 12s. per ton . . .	13·7d.	12·0d.	12·0d.
Wages	3·3.	1·7.	1·4.
	17·0d.	13·7d.	13·4d.
Less—			
Coke at 10s. per ton . . .	5·7	5·7	5·2
	11·3d.	8·0d.	8·2d.
Add capital charges at 7½ per cent.	·9	1·7	2·25
Maintenance of coal plant and machinery allowing period of 15 years for full depreciation	—	·54	·3
Net costs per 1000 cubic feet	12·2d.	10·24d.	10·75d.

The returns for tar and ammoniacal liquor are taken to be practically the same in all cases, as are repairs and renewals of retorts.

The estimated figures for the horizontal house with stoking machinery have been more than borne out by the last year's working so far as the net result is concerned. With regard to the estimated figures taken for the results with vertical retorts, these appear fair by comparison with such results as have been published where small vertical installations are in operation.

In deciding on the type of plant to be installed at Ormskirk, there were several other points apart from capital which influenced the selection of horizontal retorts and stoking machinery. A fairly high quality of gas has to be maintained on account of the large number of flat-flame burners in use, which die hard in country towns. Gas is also being supplied at very low rates for power purposes. In consequence the proportion of power gas is high, being about 20 per cent. of the total gas sold; and it was considered essential that, on account of this consumption, the calorific standard of 580 to 600 B.Th.U. should be maintained. Further, the class of coal in use consists for the most part of fine slack; and it was considered inadvisable to alter this, especially as all coal has to be carted into the works and carriage is consequently heavy.

The principal objection to the installation of machinery in small works is possible difficulty to be faced in the event of breakdowns, which are more likely to jeopardize the supply than in larger works which are fully equipped with repairs shops and skilled fitters. Further, it is not advisable, on account of capital expense, to put down electrical plant in duplicate, as is customary in large installations. It is, therefore, of importance that particular attention should be paid to the selection of the plant, so as to obtain reliability and simplicity.

The benefits to be derived from machinery in small works are not by any means confined to the saving to be effected in wages and better results, as in most districts there is the serious difficulty of obtaining skilled men for retort-house work in the winter months, and consequent losses through unskilled hand stoking. The labour trouble was a serious one at Ormskirk, and was one of the principal reasons for the installation of stoking machinery.

Retort-House and Coal-Store.

The retort-house is a steel framed building 88 feet long and 42 feet wide inside the walls. The coal store adjoins and runs the full length of the retort-house; the inside dimensions being 88 feet long and 40 feet wide.

Foundations.

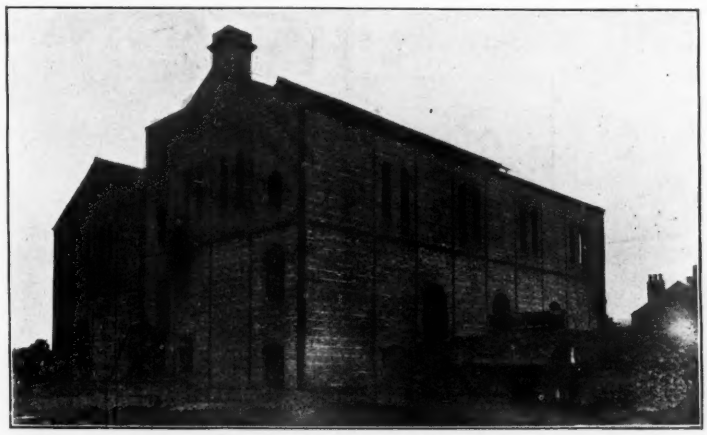
The foundations were a source of trouble, as the subsoil consists of running sand and water, which commences at a depth of 3 feet below the surface and extends to a depth of 16 feet, where there is a shallow gravel bed on top of loamy clay.

Owing to the great depth of the clay, it was decided to float the foundations in the sand and to reinforce them longitudinally. The main stanchions are each supported on blocks of concrete, 6 feet square and 4 feet deep, which are interconnected with 3 ft. by 3 ft. reinforced concrete beams, which serve to carry the brickwork between the stanchions. The retort-bench is erected on a reinforced concrete raft, 86 ft. long by 17 ft. 6 in. wide by 3 ft. 6 in. in thickness. This is reinforced with Γ-iron and angle iron laid diagonally in two layers. The bars used for the reinforcing of the foundations consisted entirely of ironwork from a recently demolished gasholder. For the coal-breaker and elevator boot a depth of 13 ft. 9 in. was required. It was necessary, therefore, that the foundations for this pit should be carried to the clay. A cofferdam was constructed with sheet pilings, which were driven down with large sledge hammers as the excavation proceeded. At the same time a sump-hole was excavated outside the cofferdam, so that the water could be pumped out during the progress of the work. This sump-hole was sunk to a depth of 3 feet below the main excavation, and was pumped continually during the construction of the pit. A bed of concrete 2 feet thick was first placed in the bottom of the pit, and the inside walls were constructed in concrete 18 inches thick inside the cofferdam. The whole of the concrete was then covered with a 2 inch layer of Trinidad asphalte. Another foot of concrete was then placed on the top of the asphalte in the bottom of the pit, and 9 inch walls in cement brickwork were erected up the sides. As the walls were built up they were run in with cement, so as to fill any interstices between the asphalte and walls, and prevent bulging or cracking where the water pressure eventually came upon the asphalte. The final lining of the walls with brickwork in cement made a very neat finish to the work, and came out cheaper than concrete would have done with the extra shoring required.

Retort-Bench.

The house contains six settings of six 24 in. by 16 in. by 14 ft. through retorts fired by deep regenerative furnaces, with a total carbonizing capacity of 450,000 cubic feet per diem. There is space in the house for the erection of a seventh bed of retorts, which would make the plant sufficient for a maximum make of 525,000 cubic feet. It will be noted that the length of the retorts is 14 feet, instead of 20 feet through, as is the general practice. The latter size would, however, have formed too large a unit, especially as the gasholder storage capacity is limited—being only 53 per cent. of the maximum day's output of gas. Results have since proved the setting to be a very economical one in working, so far as the fuel account is concerned, and no advantage would have been obtained by putting in larger settings.

The bench is provided with a separate hydraulic main to each bed, and the ascension-pipes, which are all on the charging side, are 7 inches in diameter. The separate hydraulics are connected



The Retort-House and Coal-Store.

by means of an 8-inch gas take-off to a 14-inch steel foul main running the full length of the house. The mouthpieces on the charging side are attached to the retorts by means of loose cast-iron sockets, giving greater stability for taking the apron plate of the machine. The hydraulic mains are of large section, being 2 ft. 6 in. wide by 2 ft. deep at the back; the bottom of the main having a fall of 6 inches from front to back, where a 4-inch tar-valve leads to a 6-inch tar-main connected up to the tower placed at the end of the bench. The seals are regulated by means of a weir-valve on the overflow of the liquor.

I might here point out that the only difficulty that has so far been found in the working of the plant has been caused by the stopping of this 6-inch tar-main with pitch at a time when there were five beds working. Large inspection covers were provided on the mains; and these had to be removed for clearing it of thick tar three times during the past winter. It has, however, now been decided to substitute 6-inch valves to each hydraulic, and to run a 9-inch tar-main along the bed. These sizes are much larger than is generally considered necessary. I am, however, strongly of opinion that there are many plants that would greatly benefit if provided with larger tar connections for the removal of the tar from the hydraulic main.

The regenerators are of the Drake tubular type, and have a depth of 8 ft. 6 in. from the centre of the fire-bars to the producer arch.

Coal Plant.

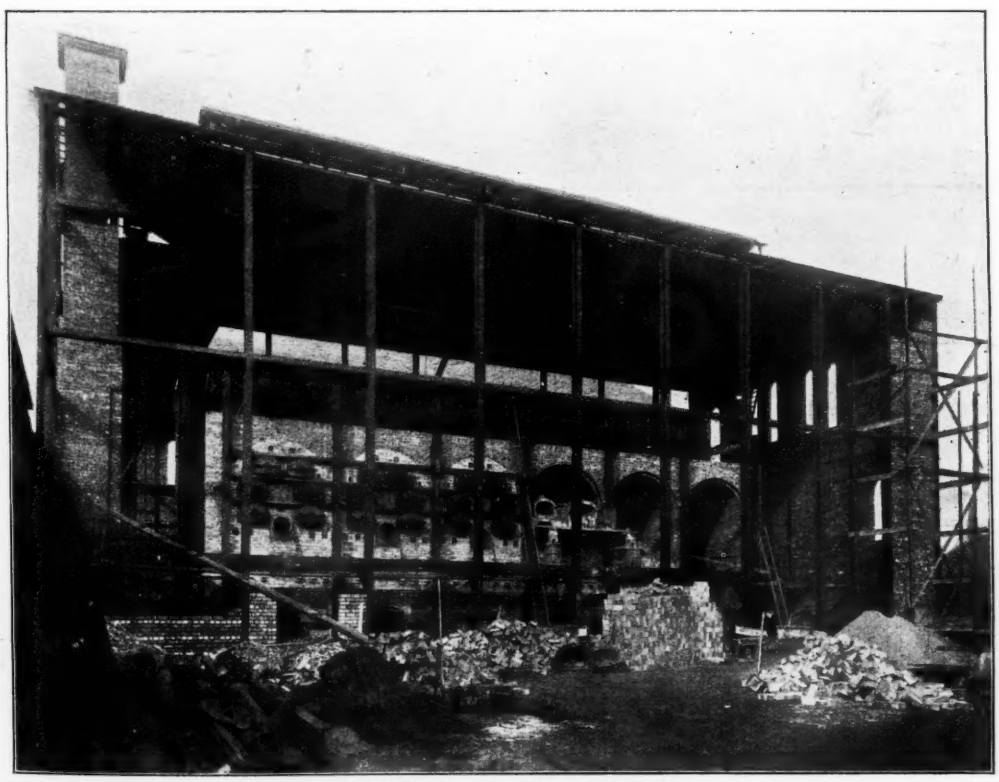
The coal is carted into the works, and the carts tip into a large feeding hopper over the breaker pit. This is provided with an adjustable door over the jigging-screen, so that the coal can be heaped into the hopper without any fear of overloading the elevator. It is also a convenient arrangement when different classes of coal are being used at the same time.

The coal breaker and jigger are driven by a 9 H.P. totally enclosed electric motor coupled direct by means of spur-gear. This has proved a satisfactory arrangement, and is not subject to troubles such as are the case where a belt-drive is working, with a consequent tendency to draw up coal dust.

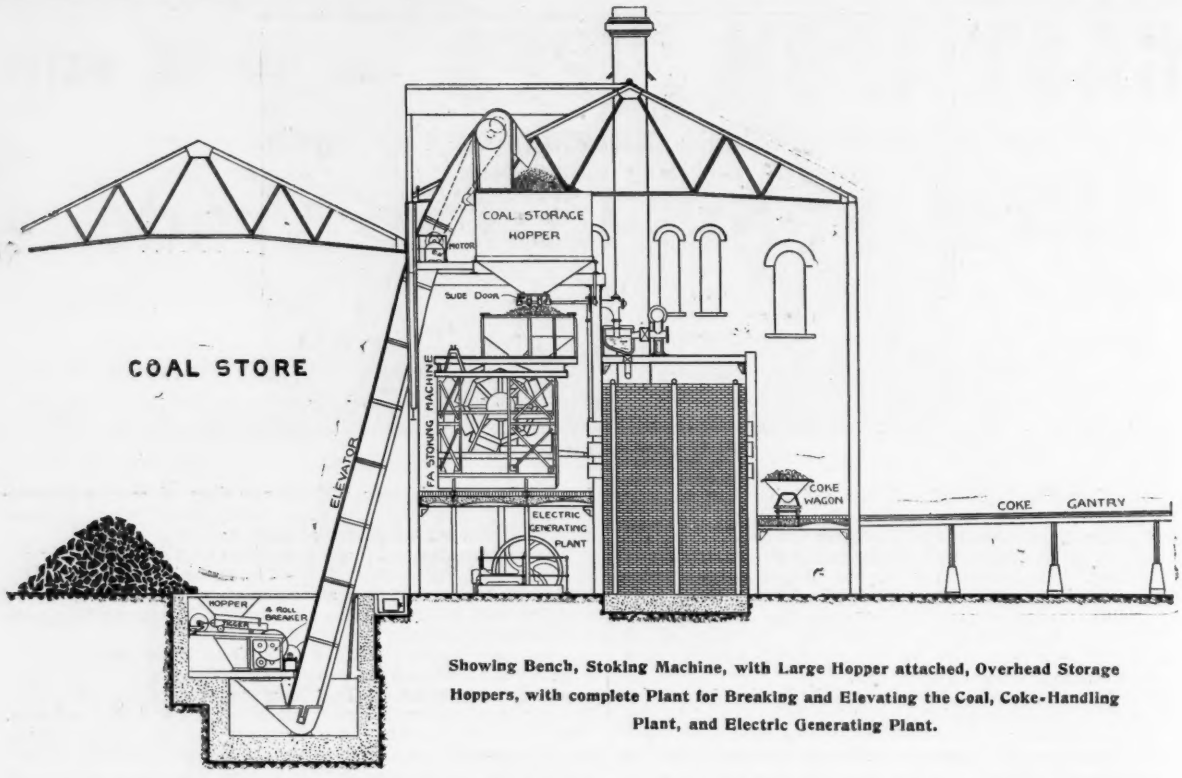
The coal elevator, which is of the ordinary bucket type, is driven from a 5 H.P. motor by means of a chain-drive, and has a capacity of 10 tons per hour. The elevator discharges the coal direct into a 30-ton overhead hopper placed at the end of the house. This holds sufficient coal for a day's supply, and the working is arranged so that the stokers fill up the hopper immediately after each charge, before stopping the engine, so that in case of any breakdown of the breaker or elevator there is always a margin of storage in hand.

Stoking Machine.

The stoking machine is a Fiddes-Aldridge sumultaneous charger discharger. It is similar in most respects to the standard Fiddes-Aldridge machine, except that it is provided with a 14 feet chain and chain wheel, and a sliding apron plate which travels backwards and forwards with the chain. This apron plate is an improvement on the old lifting type, in so far as it is cleaner in working—very little coal being spilt on the floor of the house. This machine is perhaps the heaviest and largest at present on the market; and on these points one might consider it unsuitable for small gas-works. It has, however, essential points necessary under these conditions—*i.e.*, it is simple in action; all the parts having slow



RETORT-HOUSE IN COURSE OF CONSTRUCTION.



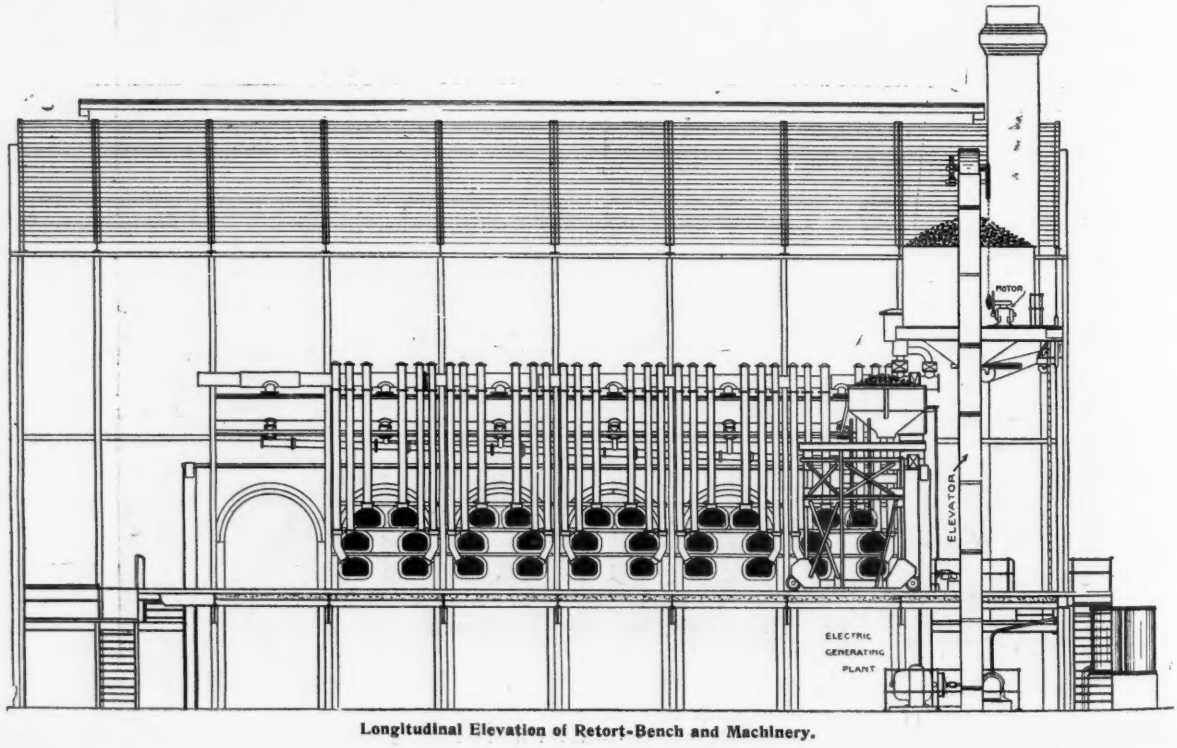
Showing Bench, Stoking Machine, with Large Hopper attached, Overhead Storage Hoppers, with complete Plant for Breaking and Elevating the Coal, Coke-Handling Plant, and Electric Generating Plant.

movements, as a result of which there is minimum wear and tear. The whole of the machine is heavy, and capable of standing much greater strain than it is ever likely to meet under ordinary working conditions, which is another point in its favour for small works, where reliability is of the greatest importance. The machine is equipped with a 3-ton hopper, so that with six beds working there is sufficient coal for one charge without travelling back to the end of the house to fill up.

Coke Handling.

The system of coke handling consists of lines of rails fixed at a convenient distance from, and parallel to the face of, the bench on the discharging side. The stage floor is 2 ft. 6 in. lower on this side, to enable the special tipping coke waggons to run under the bottom retorts, and by so doing receive the full charge of coke from any retort in the setting. There are three turntables fixed opposite the openings into the coke yard. Two gantries run from the retort-house into the coke yard for a distance of 50 feet, commencing at the same level as the discharging stage floor, and from there having a slight incline of 1 in 50 to give greater head room at the end of the gantry. The height of the gantry at the end from the yard level is 8 ft. 7 in. There is provision for putting down a third gantry when extra storage is required.

The coke is quenched in the bogies by means of overhead sprays; two sprays being fixed opposite each retort-bench. This system has proved very effective in working, as there is no shovelling or handling of coke except the pushing-out and tipping of the bogies, which entails very little labour at the end of a charge. On account of the feeding door for the producers being at a height of 3 feet above the floor, there was, when operations commenced some difficulty in working a hot coke shoot of the ordinary type. A platform was therefore constructed on a bogie to run on the track laid down for the coke waggons, and the coke-shoot constructed to move backwards and forwards on this platform. There is space on the back of the platform for a workman to stand for prodding the coke should it hold-up in course of feeding. This arrangement is a simple and effective one, and provision has been made so that the shoot can be easily removed from the platform, which is then available for inspecting as well as scaling the top retorts.



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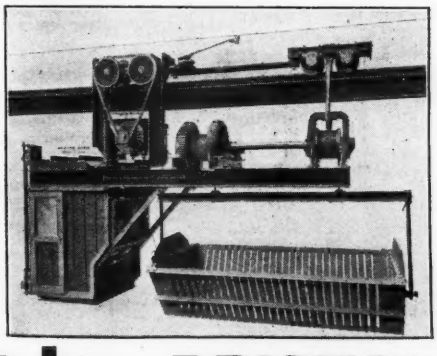

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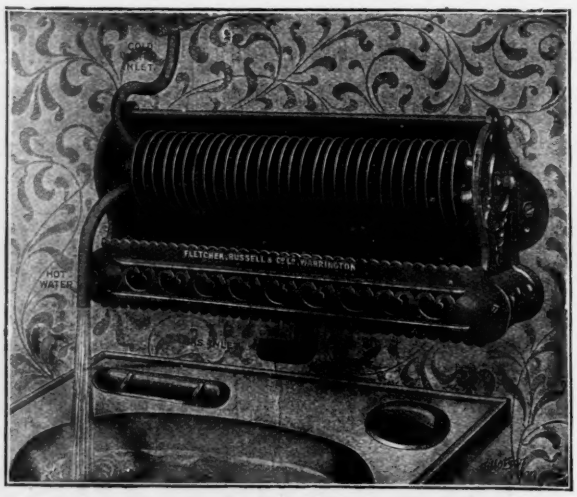

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Electric Generating Plant.

The electric generating plant is placed beneath the stage floor on the charging side of the retort-house. It consists of a 30 B.H.P. gas-engine direct-coupled by a flexible coupling to a 70 ampere dynamo at 225 volts.

Statement Showing Capital Cost of Complete Installation.

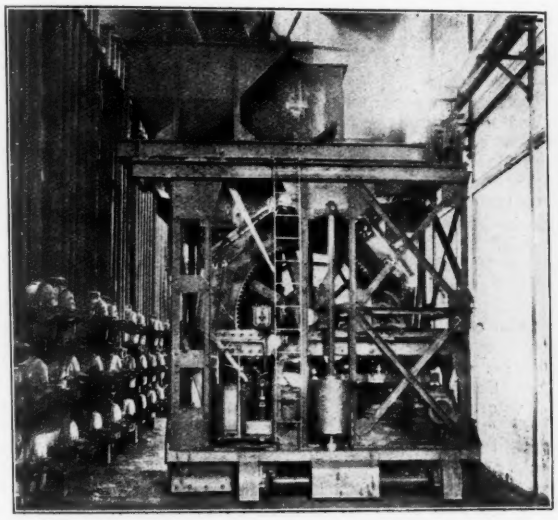
	£	s.	d.
Foundations	457	0	0
Steel framed retort-house and coal-store	1035	0	0
Brickwork and slating retort-house and coal-store	547	0	0
Stoking machinery, coal plant, storage hopper, coke-handling plant, and electric generating plant	2394	0	0
Complete retort-bench with six settings of 24 in. by 16 in. by 14 ft. retorts, chimney, and stage floor ironwork	3305	0	0
Total cost of present plant, maximum capacity 450,000 cubic feet per diem	£7738	0	0
There is space in the retort-house for the addition of a seventh bed of retorts, for which an extra expenditure estimated at £500 will be required	500	0	0
Estimated cost of complete plant, maximum capacity 525,000 cubic feet per diem	£8238	0	0

The following figures show the net cost of gas into holder per 1000 cubic feet made.

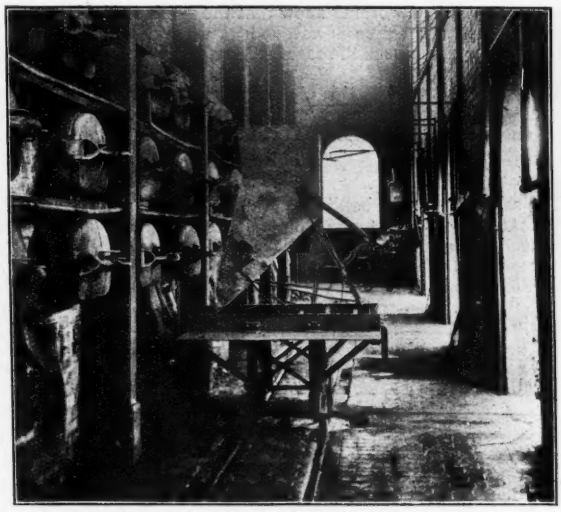
		Pence.
Coal		13·20
Carbonizing wages		1·37
Wages at works		1·01
Purification		·73
Repairs to works		2·18
Power used on works		·09
		18·58
Less coke	6·96	
,, other residuals	2·63	9·59
Net cost into holder		8·99

During the year 1913 there was no sulphate plant working, and the loss from this source is estimated at 1d. per 1000 cubic feet, as more than half the value of the liquor made was lost, owing to heavy cartage charges and difficulties of loading on rail. If this is allowed for the cost per 1000 cubic feet would not exceed 8d.

With a view to ascertaining the results that could be obtained on the carbonizing plant with a class of coal superior to that in general use on the works, a three days' test was carried out with small nuts from one of the best Lancashire Arley coals, the results of which were as follows:—



Fiddes-Aldridge Stoking Machine with Three-Ton Coal Hopper.



Retort-Bench—Discharging Side—Showing the Hot Coke Shoot on the Travelling Platform.

Taking the average yield per ton on the class of coals carbonized at 12,000 cubic feet, the capital cost per ton on the maximum capacity of plant is £206. When the seventh bed is erected, the capital cost per ton will be £188.

Working Results.

In considering the working results of any undertaking it is in my opinion of great importance that attention should be first directed to the quality of gas supplied, and the nature of the coals employed. The net cost per 1000 cubic feet is not always a comparable figure, as it does not allow for varying qualities. It is possible, however, that when the calorific standard becomes general, and records by means of accurate recording calorimeters are available, the results will be figured on the cost per million thermal units.

The new carbonizing plant at Ormskirk commenced working in November, 1912; so that the results for the full year ending Dec. 31, 1913, are available. The coal carbonized was 6219 tons, of which 4300 tons was slack, the rest being 1419 tons of through and through coal, and 500 tons nuts. The average price of the coal at the pit was 9s. 8d. per ton, and 13s. per ton delivered in the coal-store. The gas made was 73,472,000 cubic feet, amounting to 11,814 cubic feet per ton; the average illuminating power being 17·2 candles tested with the No. 2 "Metropolitan" burner, and the average calorific value 600 to 610 B.Th.U. gross. The coke sold was 11·92 cwt. per ton of coal carbonized, exclusive of all coke used on works. Allowing for that used on the works, the surplus coke is 12·2 cwt. per ton of coal. The tar made was 12·7 gallons per ton of coal, and 10 oz. ammoniacal liquor 30 gallons per ton.

The number of workmen employed was four for the greater part of the year, and six for the three months heaviest make. These men carried out the whole of the work in the retort-house —*i.e.*, from coal in store to coke in yard, including clinkering and attention to fires. They clean all machinery, look after generating plant, also the scurfing of retorts, and attend to the tar and foul mains. The work is done by twelve-hour shifts. The men have, however, only 11 hours actual time on duty; but the hours of actual work are about one-half this time. The machine drivers are paid 6s. 6d. per shift, and assistants 6s. per shift. The total carbonizing wages for the year work out at 16·2d. per ton of coal carbonized.

Coal used	Brynn Hall Arley nuts
Price of coal	16s. 5d. per ton delivered in coal-store
Retorts in action	Eighteen. Three beds of six retorts 24 in. by 16 in. by 14 ft. long
Weight of coal carbonized	50 tons 17 cwt.
Duration of test	72 hours
Number of charges	144
Duration of charge	9 hours
Weight of each charge	7 cwts. 0 qr. 7 lbs.
Gas made	673,800 cubic feet
Gas made per ton of coal	13,250 cubic feet
Gas made per shift of 12 hours	112,900 cubic feet
Gas made per retort per diem	12,377 cubic feet
Number of stokers	Four. Two men per shift
Gas made per man per shift of 12 hours	56,450 cubic feet
Gas used in gas engine generating power for coal plant and stoking machinery	5000 cubic feet
Cost of power per ton of coal, gas at 1s. 3d. per 1000 on works	1·47 pence
Wages per ton of coal carbonized from coal in store to coke in yard. Machine man, 6s. 6d. per shift, Assistant 6s.	17·7 pence
Surplus coke for sale	29 tons 15 cwt. 2 qrs. 14 lbs.
,, ,, ,, per ton of coal carbonized	11·714 cwt.
Average calorific value of gas at inlet to station meter	576·3 B.Th.U. gross
Average candle power of gas at inlet to station meter tested in No. 2 "Metropolitan" burner	16·2 candles

Analysis of Sample of Gas taken at Inlet to Station Meter.

Carbonic acid	2·00
Oxygen	0·10
Unsaturated hydrocarbons	3·20
Carbon monoxide	8·70
Methane	27·98
Hydrogen	50·55
Nitrogen (by difference)	7·47
	100·00

The foregoing results are I believe comparable with any that

are at present being obtained, especially as they are with only three beds of retorts working. The nitrogen content, 7·47 per cent., is low, having regard to the fact that the make of gas is 13,250 cubic feet per ton of coal. The surplus coke for sale is 11·71 cwt. per ton of coal, and the quantity of breeze is low, being only 1·85 per cent.

A gratifying feature in the working of this installation has been the excellent fuel results obtained, which prove that a small unit of six retorts can be as efficiently heated as a large setting. The low fuel account is attributable, in my opinion, to the even and regular charges; and as the charging and discharging necessitates the retorts being open a very short time, there is but little loss on this account.

It will be noted that the weight of each charge is 7 cwt. It is possible to put in a charge of 8½ cwt. with the machine. To burn this off in nine hours, however, requires high heats, and, as a result, greater wear on the setting; and I have found in the working of this plant no advantage in the heavier charge either in make per ton, fuel economy, or quality of coke. I know that this view is contrary to that held by the majority of engineers. At the same time, given even charging and medium carbonizing heats, it is possible to obtain more even quality of gas with better results, taking into account the wear and tear of the settings, than could be obtained with heavier charges.

Some of the beds which have been shut-down after sixteen months' continuous working show that the retorts are in excellent condition, and the shape is as good as when new. This would not, I believe, have been the case had the settings been worked at high heats.

The saving effected by this plant has enabled a mean reduction in price to different classes of consumers of no less than 5d. per 1000 cubic feet; and it is confidently anticipated that further reductions will follow.

Conclusion.

The selection of a carbonizing plant is perhaps the most difficult duty that falls to the lot of a gas engineer, for it is upon this that the success of a gas undertaking largely depends. It it especially in our small towns that the need for cheaper gas is being felt by the public; and I feel that from an economical standpoint horizontal retorts, with the single stoking machine performing the operations of charging and discharging from the one side of the retort-bench, is a thoroughly practicable and efficient system which will enable small undertakings to compare more favourably in the future in the matter of selling price of gas with those in large towns.

DISCUSSION.

The President (Mr. J. G. Newbigging), at the conclusion of the reading of the paper, said he was sure all would agree with him that it was excellent in character; and he hoped Mr. Carr would be rewarded by a good discussion ensuing. He had pleasure in asking Mr. A. Morton Fyffe, of Nelson, to open the discussion.

Mr. Fyffe (who was not heard to advantage owing to the peculiar acoustic properties of the Lord Mayor's parlour) said he desired to congratulate the author upon having designed and erected his works at Ormskirk in so complete and satisfactory a manner for carbonization purposes, and that he (Mr. Carr) thought he had what he believed to be the most modern method of carbonizing in small works. Some of them, in their younger days, might have been thought to be unduly optimistic; and he was afraid that, perhaps, Mr. Carr was also optimistic regarding his plant. He had installed at Ormskirk plant which he believed to be the best available. As a matter of fact, so had he (Mr. Fyffe); but his working results were different from Mr. Carr's. He did not think sufficient justice had been done to the vertical retort method of continuous carbonization. He took the figure given by Mr. Carr in the early portion of his paper, relating to the estimated carbonizing results on an annual make of 80 million cubic feet. Mr. Carr estimated the gas made per ton of coal—an average quality of 600 B.Th.U. and 17-candle power with the No. 2 "Metropolitan" burner—to be 12,000 cubic feet in vertical retorts; but he (Mr. Fyffe) thought that if he had made it 13,000 feet the figure would have been safer and nearer the mark. How did the author arrive at the figure 10·5 cwt. for surplus coke available for sale per ton of coal, against 11·5 cwt. for horizontals? Was the horizontal retort coke sold very dry? In his figures dealing with the net cost of gas per 1000 cubic feet made into the holder, Mr. Carr showed that his carbonizing wages were 1·37d. His (Mr. Fyffe's) figure at Nelson was 0·63d.; and, as compared with the cost in pence of "wages at works," his figure was 0·8d., against 1·01d. Purification was 0·13d., compared with 0·73d.; and repairs to works were 1·42d., against 2·18d. Power used on works was 0·07d., compared with 0·09d. His (Mr. Fyffe's) total on these five important items was 3·05d., as compared with 5·38d. He did not propose to deal with the question of residuals, as Mr. Carr explained that the sulphate plant was not working. The main object of the paper was the plant; but, after all, this was only one of the factors in the question of whether or not the results obtained were financially better. The speaker concluded by congratulating Mr. Carr on the excellent way in which he had submitted this question to the members, and expressed the hope that the results he expected to obtain in the future would justify his choice.

Mr. J. W. Morrison (Sheffield) observed that he was glad to see that, even in a small way, horizontal retorts were not to be scoffed at. The remarks which had been made about capital costs only endorsed his own views when he decided to lay down horizontals instead of verticals; because capital consideration was a matter of great importance both to gas companies and municipalities. The members would notice that the capital cost per ton was about £190, compared with about £300 for verticals. This, he thought, was a very serious consideration, and it had weighed with him (Mr. Morrison) in putting in horizontals. He did not, however, agree with the author of the paper when he said that "the class of coal in use consists for the most part of fine slack; and it was considered inadvisable to alter this, especially as all coal has to be carted into the works, and carriage is consequently heavy." In this case, a better quality of coal would have influenced him (Mr. Morrison) rather than the poorer quality. The author also stated that the length of the retorts was only 14 feet instead of 20 feet through, as was the general practice; and he accounted for it by stating that the latter size would have formed too large a unit. But it seemed to him (Mr. Morrison) that Mr. Carr's minimum was one-third of his maximum, or he need not have gone to 14 feet. He did not know whether any particular reason induced Mr. Carr to substitute 6-inch valves to each hydraulic main, because of the stopping of the tar-main with pitch at a time when there were five beds of retorts working; but he (Mr. Morrison) did not know why the author should not say 12-inch. His own view was 6-inch, so as to have a greater fall and get the tar away more quickly. The 9-inch valves would, sooner or later, give the author as much trouble as the 6-inch which he had described. The paper appealed more to the general body of members than to those who controlled the larger gas undertakings; and he congratulated Mr. Carr upon it.

Mr. Edward Allen (Liverpool) said in the first place he desired to express the pleasure he felt in attending the meeting. He was doing so in a double capacity—not only as a member of the Manchester Institution, but also as President of the parent Institution. Addressing the President, the speaker went on to say how much he appreciated the visit to the Rochdale Road works in the morning to inspect the new installation of vertical retorts, and also the visit to the laboratory, which was of very great interest. He felt sure that in Manchester they were dealing with the problem of supplying gas in a most excellent way. With regard to Mr. Carr's paper, he desired to offer his congratulations to him on the nature of it, and to the Manchester Institution in enrolling him as a member. Here, he said, was a case of a new member getting to work at once. After paying a tribute to Mr. Isaac Carr's services to the profession, Mr. Allen said he was sure he voiced the feelings of all the members of the Institution when he heartily wished Mr. Carr, junr., success in his career. ["Hear, hear."] In yet another sphere—parliamentary work—Mr. Carr had already won his spurs; and, when one was told that a very eminent barrister had a high regard for his abilities, one could only say that Mr. Carr had done very well. Returning to the subject of the paper, Mr. Allen said it was of interest to everybody. It was the old question—dividends were made in the retort-house. This being so, the question of what was the best system of carbonization was what they all had to consider. There was no doubt that the author of the paper had this advantage: He went to a broken-down works at Ormskirk, and he saw his chance and took it. Mr. Carr said so in his paper; and he (Mr. Allen) was of opinion that he had made good use of the opportunity. Of course, they, as engineers, were all wondering whether they ought to have vertical or horizontal installations, or even go so far as coke-oven plants. Mr. Carr had laid down his premises in a very fair way; and he (Mr. Allen) had read his remarks with a great deal of interest. At the same time, he did not think he would have put in 14-feet retorts. He would have preferred 20-feet ones, because this would have given increased capacity to the plant at a comparatively small cost. He was rather surprised, however, to find that Mr. Carr claimed that he obtained better results with slack and nuts than with good Arley coal. There was, however, one point on which they were all in agreement, and it was that machinery of some sort must be used for retort-house work. The question of make was one of individual study and inquiry; and it was for them to say what particular machine or method suited their circumstances. The difficulty of obtaining skilled workmen in the winter was one which all engineers experienced; and he had no hesitation in giving his opinion that Mr. Carr had acted wisely in discarding hand labour and adopting machinery. He would not, however, say that he had acted unwisely in going in for horizontal in preference to vertical retorts; but his (the speaker's) experience led him to the opinion that verticals were the best. He was almost tempted to say that they had not heard the last of coke-ovens, because there was now working in America a horizontal coke-oven continuous process, which was being considered at the present time by some of their English friends, and it was claimed that it possessed many advantages. It was said to have been working for six years without causing trouble. If this was true, they would have to consider the question of continuous coke-ovens. Carbonizing problems would, however, be with them for many years. Mr. Allen concluded by heartily congratulating Mr. Carr on his paper, and the ability shown in it.

Mr. H. Kendrick (Stretford) said he followed in full chorus with the speakers who had preceded him in regard to the thanks due to Mr. Carr for his excellent contribution. As the author had pointed out, he had a most unique opportunity when confronted with an obsolete plant, of making a fresh start upon entirely new lines, and with an up-to-date plant. He took advantage of it; and he was to be congratutated upon it. He (the speaker) could not,

however, agree with all the figures in the paper. For instance, he said that 7 or 8 cwt. charges were better than 12 or 13 cwt. or even heavier charges. He (Mr. Kendrick) had a distinct recollection of having a conversation with a distinguished relative of the author on this very question; and he thought that relative's view was that a 16 or 17 cwt. charge was much preferable. He (the speaker) had just prepared for him a statement on the matter of carbonizing wages on the Guest-Gibbons stoking-machines and the Strachan and Henshaw telpher; and the figures were given in the cut away, and the new bench extended to 14 feet; the arches being filled with 24-inch by 16-inch retorts, 14 feet long, of similar section to those of Mr. Carr. The result was that they had a machine-worked house of 600,000 cubic feet capacity in place of one of 300,000 cubic feet, for an outlay of £93 per ton of coal carbonized per diem. This outlay included the settings, alteration and addition to the house, machinery, coal elevator and hopper, steam-generating set of 45-kilowatt capacity, &c. At the figure named, it was the only scheme he could recommend. If an

Carbonizing Wages on Guest-Gibbons Stoking-Machine and Strachan and Henshaw Telpher.

—	Winter.			Spring and Autumn.			Summer.			Average for Year.		
		Wages.	Pence per Ton.		Wages.	Pence per Ton.		Wages.	Pence per Ton.		Wages.	Pence per Ton.
Coal carbonized per week .	889 tons	..	..	784 tons	..	..	469 tons	..	..	732 tons	..	..
Distillation times	10 hours	..	..	10 hours	..	..	12 hours	..	..	..	..	..
Men employed on machines, coke-skips, and filling fires	18	£36 18 0	9·96	15	£30 15 0	9·41	10	£20 5 0	10·36	15	£29 13 9	9·73
Weight carbonized per man	50 tons	..	..	52 tons	..	..	47 tons	..	..	49 tons	..	..
Clinkerers, lid men, coal wheelers, and machinery attendants	12	22 11 5	6·10	8½	16 3 1	4·94	6	11 0 0	5·63	9	16 9 5	5·40
Foremen and exhauster men	6	14 0 8	3·79	6	14 0 8	4·29	6	14 0 8	7·18	..	14 0 8	4·60
Electrical energy used, steam, oil, waste, &c. . .	620 units	5 18 7	1·60	408 units	4 3 0	1·27	302 units	3 7 5	1·73	..	4 8 0	1·44
Repairs and renewals . .	..	..	1·00	..	..	1·00	..	..	1·00	..	..	1·00
Total	..	..	22·45	..	..	20·91	..	..	25·90	..	..	22·17

accompanying table. He did not agree with the author of the paper when he said that 12 or 13 cwt. charges did not yield satisfactory results. But could he not lengthen the period of carbonization? The results at Stretford had been eminently satisfactory in this respect, both in yield of gas and quality of coke. The author stated that to burn off a charge of 8½ cwt. would take nine hours with the machine, and that this required high heats, with, as a result, greater wear on the setting. But his (the speaker's) experience in regard to the Stretford works was to the contrary; at any rate, he had not as yet found it so. Mr. Carr's claim that the condition of his retorts would have been worse had he worked heavier charges for longer periods was not borne out by the experience of many of those present. He congratulated Mr. Carr on the results he had obtained from fine slack, which, he said, was an achievement which most of them would like to rival. It would be interesting to know from what particular slack such good results were obtained. Personally, he had always found that the rougher the slack the better the results he obtained. With regard to the question of the length of the retorts, he did not quite agree with Mr. Allen in reference to the 14-feet size being uncommon in construction. For the capacity of Mr. Carr's works, it was, he thought, almost an ideal size to erect; and in addition to this the price of construction was reduced correspondingly. Mr. Carr was not, however, the first in the field with settings of the kind. He (Mr. Kendrick) had a distinct recollection of seeing similar settings at Pye Bridge and other places—Colwyn Bay for one, if he remembered rightly. He knew that these had been entirely successful. The cost of erecting the Ormskirk plant, considering the difficulties with foundations, was remarkably low. Mr. Carr was fortunate in being able to start *de novo;* and he was, of course, placed in a better position than those of his colleagues who had to erect plant in less favourable circumstances, and whose installations were in far too good a condition to scrap. In the case of his own plant, it would be three or four years before he put it at its full capacity; but when he arrived at this stage, he hoped to emulate such figures as the author of the paper and Mr. Fyffe had placed before them. He was glad to see that Mr. Carr had put down his working costs on the average of the twelve months' working—a point which other people did not always observe when enlarging on the advantages of plant they had recently installed. Such practices led to confusion in other channels; and it was annoying to be faced with figures which, by comparison, had simply been based upon the best working results achieved over a particular period.

Mr. J. Smith (Colwyn Bay) congratulated Mr. Carr on his exceedingly useful and interesting paper, and on his fair and just treatment of the claims of the type of carbonizing plant he had installed at Ormskirk. He had undoubtedly shown that some vitality remained in this method of carbonization. At Colwyn Bay there was almost identical plant; and, in the main, he (Mr. Smith) could support Mr. Carr's statements. There were, however, one or two points on which his own and Mr. Carr's experience differed. The principal one was the weight of the charge. He had invariably obtained the best results with a fully charged retort and an extended period of time to fully carbonize the extra weight. This, to his mind, was borne out by overwhelming evidence, and by the authority of gentlemen who had given time to study and research—notably Mr. Bell and Mr. Thomas Glover. Further, most managers must, at one time or another, have tried increasing their charges in hand-stoked retorts from (say) 2½ cwt. to 4 cwt., and experienced the efficacy of the change. He thought the general consensus of opinion was in favour of heavy charges. At Colwyn Bay, unlike Mr. Carr, they had an excellent retort-house, filled with two single benches and a stack between them. The charging-floor was at the yard level. The side wall was partially entirely new plant had been necessary, he would not say that vertical retorts might not have been considered. Their machine was the Guest-Gibbons, and it had the advantage that, with the size and length of retort adopted, the charge could be varied from 8 to 11 cwt. The chief reasons for deciding upon this make were easy manipulation, flexibility in the size of the charge, and (more especially in a non-industrial centre) the smoothness and quietness of its working. The cost of upkeep so far had been *nil;* and there were no evidences of wear taking place. The whole of their anticipations had been more than realized during the nine to ten months it had been at work. In the matter of labour costs they came out lower than Mr. Carr's, with a scale of pay approximating his; the average for the year being a very small fraction over 1s. per ton of coal carbonized. This included all labour from the coal-store to the coke-yard, the attendance to the furnaces, keeping the machinery clean, and looking after the boilers and exhausters. The low cost was, to his mind, another factor resulting from the heavier charges—two charges almost equalling three with Mr. Carr's machine. It did not matter with machines of this type whether the man put in 1 cwt. or 10 cwt.; his labour was almost the same. Hence the economy of his time by the adoption of the heavier charge. Mr. Morton Fyffe had stated that the results from verticals, as given in the paper, ought to be amended to not less than 13,000 cubic feet of ges per ton; and so ought that from a horizontal machine worked similarly to the author's installation, with identical gas and B.Th.U. results. Mr. Kendrick differed from the author in the latter results obtainable from slack and coal. He (Mr. Smith) had been testing in bulk slacks, nuts, and coal from the same seams, and was surprised to find the results deteriorated very little from coal to slack. From one slack were obtained results almost equal to those cited from Brynn Hall Arley. The results obtained at Colwyn Bay for the six months' working of the past financial year showed such economies that the increased coal charges were met without affecting the net cost of gas into the holder.

Mr. J. H. Davies (Oswaldtwistle) having made a few remarks,

The President said that, in summing up the discussion on Mr. Carr's practical and useful paper, he should like first of all to express his personal thanks to him for so readily responding to his request to read a paper at this meeting—particularly as he knew that the author had been very much occupied with professional work during the past few months. Mr. Carr was to be congratulated on the reformation he had effected in the affairs of the Ormskirk Gas Company, both as regards the works and general management; and it was proof of what could be done by a capable engineer who had full control of an undertaking and a free hand. It must be remembered that the paper was only a guide to gas undertakings working twelve-hour shifts, and was of little value when eight-hour shifts were in force, unless, of course, adjustments were made in the figures in order to bring them to an equal basis. It was much to be regretted that Mr. Carr did not make such adjustments. Dealing first of all with the comparative costs of small units of continuous vertical retorts and horizontal retorts and machinery erected within a stage-floor house—he (the President) could not agree with him that in all cases verticals were the more costly. In proof of this, he had recently had the opportunity of seeing two tenders for a carbonizing plant. One was for horizontals almost identical with the Ormskirk plant, and the other for continuous verticals, each plant being of a capacity of 40 tons per day, both tenders were within a few pounds of £200 per ton. But assuming that continuous verticals were more costly than horizontals, then he said they were worth the extra cost, because they had advantages with the system which did not obtain with horizontals, however much was paid for them. Continuing, the President said: "I do not propose to enumerate here

all these advantages, because I have done this on previous occasions; but I wish to draw your attention to one important advantage on which a money value cannot be placed, because it is so high. That is the freedom from nuisance to the surrounding neighbourhood of a works in charging and drawing the retorts. It is very clear, from a recent decision of the High Court, that the statutory powers of gas undertakings do not completely safeguard them from being indicted for causing a nuisance, and being landed in a position which cannot be calmly contemplated. The fact that there is a system in existence with which the minimum of nuisance prevails places in a very strong position a plaintiff or plaintiffs in any action for nuisance. For this reason it is a matter of supreme importance to a gas undertaking, when deciding whether intermittent or continuous carbonizing shall be adopted, particularly when works are situated in a congested neighbourhood." Turning to the question of working costs, the President said Mr. Carr had given his carbonizing wages as 1·37d. per 1000 cubic feet for twelve-hour shifts for the year 1913. But if for any reason he had to adopt eight-hour shifts—quite a possible contingency—this figure would be increased to 2·05d. per 1000 cubic feet. The carbonizing wages at the Droylsden works of the Manchester Corporation for the year were 1·16d.—a difference of 0·89d. on the eight-hour shift basis. Certainly they made 120 million cubic feet, against 73 million cubic feet at Ormskirk; but this figure would not have materially altered with the lesser make. It would be a very simple matter to work vertical retorts with twelve-hour shifts by increasing the size of the coal-measuring chambers at the top and the coke-receiving chambers at the bottom of the retorts at a very small cost; and the labour and exhausting and dirty conditions to workmen manipulating vertical retorts were not a tithe of those of horizontal retorts and machinery. He should say that with the light charges Mr. Carr put into his retorts he was liable to naphthalene trouble. Mr. Carr claimed a greater sale of coke per ton of coal with his horizontals than with verticals; but this, he (the President) maintained, was entirely due to the moisture in the coke. The liquid products, tar and ammoniacal liquor, were greater from vertical than from horizontal retorts—at least 5 gallons per ton; and certainly the make of the gas per ton of coal and the calorific value were at least equal to horizontals. Mr. Carr's figures of the composition of the gas were good, and the calorific value was high; but before any reliance could be placed on these it must be known how often they were taken, and the care exercised in carrying out the work. The President submitted the following figures, and concluded by stating that the figures given in his paper at Glasgow on the vertical retorts at Droylsden were taken from gas collected in a holder over the 24 hours.

Comparison of Working Results for a Year with Horizontal Retorts at Ormskirk (A) and Vertical Retorts at Droylsden (B).

	A.	B.
Coal carbonized	6,219 tons	9,179 tons
Gas made per ton	11,814 cub. ft.	13,115 cub. ft.
Illuminating power ("Met." No. 2 burner)	17·2 candles	16·79 candles
Calorific value, gross	600-610 B.Th.U.	560-570 B.Th.U.
Sperm value per ton	696 lbs.	755 lbs.
Coke sold per ton of coal carbonized exclusive of all coke used on works	11·92 cwt.	9·42 cwt.(dry coke)
Tar made per ton of coal	12·7 galls.	14·39 galls.
Ammonia water made of 10-oz. strength per ton of coal	30·0 ,,	31·59 ,,
Carbonizing wages per 1000 cubic feet—		
Twelve-hour shifts	1·37d.	0·77d.
Eight-hour shifts	2·05d.	1·16d.

Mr. CARR, in a hurried reply, dealt with a number of the questions raised during the discussion, and thanked the members for the interest they had displayed in his paper.

Water Storage in Reservoirs.—The advantages and disadvantages of water storage in reservoirs was recently the subject of an article by Mr. W. P. Mason in the "Journal of the Franklin Institute" [No. 177]. According to an abstract in the "Journal of the Society of Chemical Industry," the main disadvantages of the storage of drinking water before distribution are the increase in colour of the lower layers of the water if the bottom of the reservoir is not clean, the growth of small organisms producing taste and smell due to an abundance of food-material extracted from the ground forming the bottom, and the deficiency in dissolved oxygen in the lower layers. An important point is the protection of the reservoir and watershed from accidental contamination by fæcal matter. The seasonal growth of algæ is easily dealt with by treatment with copper sulphate; one part of sulphate to 3½ million parts of water being effective, at a total cost of 14·9 c. (7½d.) per million parts of water. The great advantage of storage is the destruction of pathogenic and other bacteria; but care must be taken that the whole of the water undergoes the stated period of storage. A case is cited of a narrow lake, 10 miles long, in which the prevailing wind blew in the direction of the flow of water down the lake. Sewage matter entering on the surface at the head of the lake was carried to the lower end, where the water intake was situated, in as little as three days. Emergency water intakes, which are frequently in inferior positions, should not be used unless the water can be properly stored.

NOMENCLATURE AND DEFINITION OF PHOTOMETRIC MAGNITUDES AND UNITS.

By A. P. TROTTER.

[Extracts from a Paper read before the Illuminating Engineering Society, Thursday, May 21.]

At the Baltimore Convention of the Illuminating Engineering Society of New York, on Oct. 24, 1910, a report was submitted by Professor A. Blondel, Dr. A. E. Kennelly, Professor E. L. Nichols, Dr. E. B. Rosa, and Professor C. H. Sharp, members of a Sub-Committee on Photometric Units. After holding many meetings, another report was presented in December, 1912, submitting certain definitions to be tentatively adopted. The object of the present paper is to examine these definitions and elicit some discussion on them.

There can be no question about the scientific accuracy or logical exactness of a report coming from authorities so well known by name and reputation to all those who have made a study of the science and industrial applications of photometry; but questions may be raised about the terminology and choice of units and the general scheme of the proposition.

The measurements of modern physical science are securely established on three fundamental units of length, mass, and time. Everett pointed out that "this particular selection is a matter of convenience rather than of necessity; for any three independent units are theoretically sufficient." He also observed that it is desirable that fundamental units should be so chosen that the definition of the various derived units shall be easy and their dimensions simple. To this may be added that it is an advantage that a well-known or frequently-used magnitude should be the fundamental rather than one which only appears after theoretical considerations. For most of us it is better to anchor ourselves to the most simple units that we can find, and then, letting out the cable of inductive reasoning, float over wider and wider ranges of ideas, always co-ordinating them to our bearings.

The first and fundamental quantity chosen by the Committee is: "*Luminous flux* is radiant power evaluated according to its capacity to produce the sensation of light." The natural and obvious quantity would, to most of us, seem to be "candle power." This, however, comes as the seventh quantity, and is defined: "*Candle power*—luminous intensity expressed in candles." This sends us to "luminous intensity," the fourth quantity in the report, which is thus defined: "*The luminous intensity* of a point source of light is the solid angular density of the luminous flux emitted by the source in the direction considered; or it is the flux per unit solid angle from that source."

None of these are simple, and the last appears to be a rather complex quantity, especially to anyone who knows little or nothing about solid angles or flux, but who *thinks* that he knows what is meant by "candle power." Twenty-four years ago I wrote: "Light being an expenditure of energy, candle power is an accurate term, since it is the measure of the rate of expenditure of energy." To this it may be answered, "Why drag in energy?" Light is defined in most dictionaries and encyclopædias subjectively, as in the first definition of the report of the Committee in 1910. "Light is the stimulus produced by radiation, which excites vision." But light may also be defined objectively. The sensation of light is a subjective affair, to which magnitudes and units cannot be applied. It is one of the elementary principles of photometry that the only ratio that can be visually determined is that of equality.

The term "candle power" is used in two senses. In one sense it connotes an abstract idea like area or pressure; in the other it is a vector quantity and denotes a definite physical magnitude. In the former sense it is synonymous with "luminous intensity," but has taken such a hold on the English language that it is difficult to get rid of it. In the latter sense, the name of the physical unit of luminous intensity, the "candle," may often be substituted for "candle power." Professor A. Blondel shudders not only at our expression "candle power," but at our use of "candle" as a physical unit. "It is as unscientific," he writes, "to call the unit of intensity 'an international candle' as it would be to call the unit of electromotive force an 'international battery,' or the unit of heat an 'international stove.'" This intensity, or strength, or power, or rate of emission of light is a simple vector quantity, although in some cases—such as in a thick mist, or in the upper part of a lighted candle—the direction is not possible to define. Assuming a sensibly transparent homogeneous medium, and a point source, the direction is radial to the source and the unit of intensity is that of one "candle." This, on account of its simplicity and primary character, has strong claims to be regarded as the fundamental unit in photometry. There does not appear to be any reason for defining luminous intensity or candle power as the solid angular density of the luminous flux emitted by the source. The idea of a solid angle may be dismissed in considering the luminous intensity of a source of light; the idea of flux density imports redundant dimensions. It may be said that here is a false analogy. Our practical unit is the pound, not the pound per square inch. True, but Everett furnishes the answer—it is a question of convenience, and the fundamental units should be easy of definition and of simple dimensions. The relation between a lumen and a candle power is a mere matter of arithmetic. The choice of luminous intensity or candle power for the funda-

mental magnitude defers the conception of flux and solid angle until these are wanted.

The magnitude of second importance, but coming fifth in the list of the Committee, is "illumination." This is thus defined: "*Illumination* on a surface is the luminous flux-density over that surface or the flux per unit of intercepting area." Seeing the great industrial importance of describing, specifying, calculating, and measuring illumination, and seeing, too, that the units foot-candle and *metrekerze* are well established, it is unfortunate that a definition of this quantity should be proposed which is so difficult for a layman to grasp. To understand what is meant by illumination, let us not generalize about the concept, but go straight to the units by which it is always measured. Illumination consists of two factors—candle power and distance. The British and United States unit is the foot-candle. It is the illumination *received* from the source of 1-candle power falling perpendicularly on a surface a distance of one foot from the source. The United States definition "*Illumination* on a surface is the luminous flux-density over that surface, or flux per unit of intercepting area," and the definition of the unit "*Lux*, a unit of illumination equal to one lumen per square metre," sends us wandering over the definition of flux density and its unit—"*Lumen*—the unit of luminous flux, equal to the flux emitted in a unit solid angle (steradian) by a point source of one candle power." The definitions, which are quite unintelligible to a layman who has not given some consideration to the conceptions of flux and solid angle (the term "steradian" is practically unknown in Great Britain), contain dimensions which are not logically necessary, and which give rise to the complication. The lumen, originally introduced by Professor Blondel, is a very important unit; but it should be a derived one, just as a unit of volume is derived from the unit of length.

The introduction of a solid angle and an intercepting area is as tautological as speaking of a horse-power-hour per hour. The simple foot-candle definition demands only the mental picture of a candle and a small surface facing it, which, if fairly small—say, the size of a penny—may be flat, for the illumination at the edge of such a disc received from a theoretical point source will be 0·996 of the illumination at the centre—that is to say, practically uniform. This conception of the unit of illumination makes for economy of thought.

It is highly satisfactory that the "candle"—a definite physical quantity measurable to a fraction of one per cent.—has been agreed upon by the authorities in the United States, France, and Great Britain; but so long as the Hefner unit is also regarded as a unit of intensity of illumination, it is not wise to use the terms lumen and lux without qualifying them as candle-lumen, Hefner-lux, &c.

After reference to some little used unit terms, the author said the next term on the list is *Brightness*. This word is used in two senses, emissive brightness of a source of light, and reflective brightness of an illuminated surface. The Committee's definitions relate apparently only to the former. "*Brightness of an element of a luminous surface from a given position* is the luminous intensity per unit area of the surface projected on a plane perpendicular to the line of sight, and including only a surface of dimensions negligibly small in comparison with the distance of the observer. It is measured in candles per square centimetre of the projected area." "*Normal brightness of an element of a surface* (sometimes called *specific luminous intensity*) is the ratio of the luminous intensity of the element taken normally to the surface of the element, and is expressed in candles per square centimetre." Perhaps this refers to secondary brightness of a diffusive reflector. If so, there seems to be no need for restricting it to the normal direction. Such reflectors are very useful in other directions. The pith of these two definitions is that brightness is to be expressed in candles per square centimetre. The rest, and the equations which are given in the report, explain how the definitions are applied. Emissive brightness, when not expressed in candles per square inch, has hitherto been given in candles per square millimetre. The brightness of the crater of a carbon arc is about 160, and of a candle flame about 0·39 candle per sq. mm. We have also the word "luminosity," but that has been used by Abney and others in connection with the spectrum. Brightness has another and very important meaning for which the term "surface brightness" or "secondary brightness" is sometimes used. It is of great practical importance that "surface brightness" should be recognized as a definite and accurately measurable physical magnitude, whatever name is given to it. It is a compound quantity consisting of two factors, illumination and the coefficient of diffused reflection. Several practical instruments with which industrial photometry is carried out depend entirely on the measurement of brightness. Sometimes the object is not to measure brightness, but to measure illumination. For this purpose a piece of white card or unpolished celluloid is used. When this receives an illumination of 1 foot-candle and is observed through the instrument, the brightness is found to be equal to the brightness of a screen contained in the instrument when 1 foot-candle is indicated on the scale. The instrument being duly calibrated by experiment, measurements of illumination may be made with it.

But this unit reading does not correspond with the true unit brightness. The card or celluloid reflects only about 80 per cent. of the light incident on it—in other words, its coefficient of diffused reflection is about 0·8 or its albedo is 0·8. If this is measured, the coefficient of diffused reflection of other surfaces receiving the same illumination may be directly compared. A knowledge of this coefficient for different coloured paint, distemper, or wall paper is of great practical importance. This coefficient is the next term defined.

Coefficient of Reflection.—"The ratio of the total luminous flux reflected by a surface to the total luminous flux incident upon it. It is a simple numeric. The reflection from a surface may be regular, diffused, or mixed. In perfect regular reflection all of the flux is reflected from the surface at an angle of reflection equal to the angle of incidence. In perfect diffused reflection the flux is reflected from the surface in all directions in accordance with Lambert's cosine law. In most practical cases there is a supposition of regular and diffuse reflection." This is an excellent statement of the matter. It is analogous to transparency which is regular or to translucency which is diffuse. In measuring regular transparency—such as that of neutral tinted glass—it is sufficient to place a specimen in the path of a beam of light and then observe the effect upon the apparent candle power of the source. But attempts to measure the absorption of ground glass and opal glass in this way have often led to the publication of erroneous results. The light scattered over a hemisphere must be taken into consideration, samples must be measured at different angles, and the whole sum must be calculated. Since surface brightness consists of the two factors, illumination and the coefficient of reflection, and since brightness can be accurately compared and illumination can be accurately measured, this coefficient may be deduced without measuring flux as such, and without introducing the lumen into the work.

Mean horizontal candle power of a lamp is defined as "the average candle power in the horizontal plane passing through the luminous centre of the lamp. It is assumed here that the lamp (or other light source) is mounted in the usual manner, or, as in the case of an incandescent lamp, with its axis of symmetry vertical." "*Mean spherical candle power* of a lamp—the average candle power of a lamp in all directions in space. It is equal to the total luminous flux of the lamp in lumens divided by 4π." "*Mean hemispherical candle power* of a lamp (upper or lower)—the average candle power of a lamp in the hemisphere considered. It is equal to the luminous flux emitted by the lamp in that hemisphere divided by 2π." These three definitions are of great practical importance; and, being practical, the corollary about flux (for it is nothing but corollary) might have been omitted. In the case of all gas-mantles and electric glow lamps, excepting perhaps those with a conical arrangement of filaments, the mean horizontal candle power is a definite term, and the one which will naturally be used by manufacturers in testing and marking, since it is generally the maximum. It would be difficult to induce them to use the mean spherical candle power as an ordinary description even if any good reason could be found for asking them to do so. The present fashion of rating electric glow lamps in watts is a step in this direction, for the watts mean nothing to the layman; but if you give him the watts per candle, you must give him horizontal or mean spherical candles. In the case of arc lamps the mean horizontal candle power is practically useless. The choice lies between spherical and hemispherical; for the maximum candle power which used to be given in a plain, common-sense way, is not likely to be revived. It is not much use for theoretical men to dictate to arc lamp makers how they shall describe their goods. All that can be done is to settle the definitions, and invite them to agree upon some common usage.

The author then dealt with the question of the use of symbols; and concluding said the nomenclature of the chief photometrical terms is ripe for settlement. It is first necessary that the terms should have a well-defined meaning, and that this should meet with general acceptance. This is one branch of science in which originality is not wanted; the word-coiner is too often a crank and a nuisance. Photometry and illuminating engineering have not sprung suddenly on the world like wireless signalling and flying. In such work the inventors must produce words to describe their discoveries and inventions. But we have a literature of a hundred years behind us. It should be our object to record what appears to be the general usage of the day rather than to guide the scientific literature of the future. In this paper the intention has been to make for lucidity and simplicity, without loss of accuracy; and thus to render the literature of the subject intelligible to a wider section of the public.

Points from the Discussion.

The President (Professor Silvanus P. Thompson, D.Sc., F.R.S.) remarked that they had communications from several important individuals who had read Mr. Trotter's paper; and there were two letters which he would ask Mr. J. S. Dow, their Assistant Hon. Secretary, to read at once. They were by Professor Blondel and Dr. Louis Bell.

Professor A. Blondel (Paris), in the course of his communication, remarked that Mr. Trotter appeared to be committed to a conservative outlook, which was somewhat in contrast to that adopted by the American Society, and by other societies in foreign countries. The American Society had aimed at establishing a system of photometric units and symbols which should be: (1) Scientific—that was to say, in direct and intimate relation with other branches of physics and carried to the same degree of scientific precision. (2) International—that was to say, containing terms capable of being adopted by all countries. It was for these reasons that it had been found impossible to adopt the term "candle power" which, although venerable by years of usage in England was completely unknown in other Anglo-Saxon countries.

For the rest, the photometric system should be framed to meet the requirements of science, and not to comply with the old-fashioned practices dating from the early days of public lighting, nor to meet the views of those who, as Mr. Trotter said, knew little or nothing about angles and flux. On the contrary, the system should be in advance of its time. It should provide engineers with scientific ideas of illumination, and conceptions in harmony with the progress of other branches of physics. It was for these reasons that it was necessary to define the luminous flux (a special form of energy) before proceeding to define the source of light. Moreover, the definition of a luminous source was not rigid, except when the source in question was a point. It was right they should consider the flux before the source of it. The conception of a flux was so convenient in practical lighting problems, both as regards interior and public lighting, that people had come to make constant use of it, and, in fact, could hardly avoid doing so. How was it possible to define illumination in a scientific manner without recourse to this quality? Moreover, by adopting this scientific conception, one found it was not necessary to draw a distinction between primary and secondary brightness. The conception of secondary brightness introduced inconvenient and useless complications, and was quite unjustifiable. In this he found himself in agreement with Mr. Trotter.

Dr. Louis Bell (Boston, U.S.A.), in his communication, owned that he had considerable sympathy with Mr. Trotter's criticism of the highly scientific, but, in his opinion, unnecessarily intricate system of nomenclature proposed by the American Committee. His own feeling was that, while the propositions viewed a decade or two hence would perhaps seem both logical and far-sighted, they needed great simplification before they could be adapted for the everyday work of illuminating engineering. He did not believe in adopting a new unit or a new symbol until it became vitally necessary with a common understanding of the subject. He had, however, little doubt that the present proposition would, as a matter of practice, settle down into some reasonably simplified form, though many of the items might go to swell the curious historical collection of unused and impracticable units laid away in the archives of various learned "Proceedings." However, it was an excellent thing to have made a conscientious attempt to bring the nomenclature of illumination into line with general scientific nomenclature, even although, for practical purposes, much of it might be laid aside. Perhaps he could clear up Mr. Trotter's difficulties on one point—that of the double definition of brightness. The two definitions were not quite what Mr. Trotter indicated. "Brightness" was used to denote the luminous intensity of the projected area of the surface considered, taken just as one found it from the position of observation. "Normal brightness" was the corresponding intensity—normal to the element of the surface considered. The first definition was the only one ordinarily used in specifying the intrinsic brilliancy of a source as seen. The second definition was the theoretical intrinsic brilliancy considering the normal surface only, and had, he thought very little practical bearing in ordinary usage.

The President asked the speakers to particularly direct attention to the order in which it was expedient to settle the various units. It was better to start with one or two that were of primary importance, so that the definitions of others might depend upon them. It was exceedingly important they should choose the right ones to begin with on which to found the others.

Mr. C. C. Paterson (National Physical Laboratory, and Secretary to the International Photometrical Commission) remarked that Mr. Trotter had used the term "candle power" to express two meanings. The paper had made him (Mr. Paterson) realize this in a way that he had never done before. They used the term "candle power" to express the conception of luminous intensity, and they also used it originally to express the numerical value of the source of light. In thinking of electric current, they spoke about the current of so many amperes; and, strictly, they ought to speak of the candle power of so many candles. They had only the word "candle" to correspond with "current" and with "ampere." They ought to use the word "candle" as a numerical value; and he thought they never ought to say that a lamp was of 10-candle power, but that the candle power of the lamp was 10 candles. If they could get clear of this point, it would help them to make the matter plainer than it was at present. Some people used "luminous intensity" instead of "candle power," in order to get rid of reiteration; but he was not sure that was happy. He ventured to disagree with Mr. Trotter as to the order in which they ought to consider these fundamental units in illuminating engineering. The author threw flux to the wind. In effect, he said: "Let us be content simply with the source and the illumination, and leave flux to the fifth or sixth place, and to those who want to bother about it." At first sight, this sounded feasible. Mr. Trotter urged that the idea of flux was something that was obscure to an ordinary individual. He (Mr. Paterson) ventured to differ from him. He thought the ordinary person's idea of light was simple flux; and there were one or two considerations which they might take into account which would emphasize this. On hoardings, they saw pictures of sources of light with streamers coming out in all directions. What were these streamers but the flux? The layman's idea of light as flux was a very natural one. Then the layman was familiar with the expression "shedding light." From his earliest childhood, he had been taught that light was "shed." Then the layman also used the expression "flooding the room with light." Therefore his whole idea of light was flux. The first point that he wished to make was that the ordinary man thought of light as flux, and did not think of it as illumination. The second point he desired to make was that, if one tried to get out a definition, and left flux in the background, without attempting to think of it, he would immediately—perhaps unconsciously—bring the conception into the definition. He wished to call Mr. Trotter's attention to his own statement as to illumination from a source falling perpendicularly on a surface. The idea of anything falling on a surface immediately conveyed the notion of flux. He (Mr. Paterson) did not think they could get rid of the conception of flux as a fundamental thing. He thought he was right in saying that there was no branch of physics in which the idea of flux was not a fundamental one, which was the one wanted most, and which was the one that was thought of most. They ought to keep their definition of light with their definitions and their conceptions of energy. The conception of luminous flux was the thing which emanated from the source; and any real consideration of fundamentals, he felt satisfied, would be quite wrong if it disregarded the conception they used, and would always continue to use. It was not light that came from the source. It was energy that came to them; and it was only light when it reached the eyes. He thought it was very necessary to separate the idea of flux of light from the flux of energy which gave the sensation of light in their eyes. He considered they ought to regard the luminous flux as a convention; it was something the energy produced. He must say the term "luminous intensity" did not seem to him to be a satisfactory expression as a synonym for candle power. The very word intensity was used to connote the idea of an area; and luminous intensity seemed to him to be an unfortunate expression. Supposing they had two sources of light—one 6 inches and the other 1 inch square, both giving the same candle power. One would say the luminous intensity was greater in the smaller than the larger area. So he wished they could find something to take the place of the term luminous intensity. It seemed to him that luminous strength was not a bad expression; but if they could introduce the word capability—if they could say "the luminous capability of the source was so many candles"—he thought they would have the whole idea.

Mr. Haydn T. Harrison agreed with Mr. Trotter broadly on one point—that the conception of the unit of illumination made for economy of thought. Mr. Paterson had brought out a different basis altogether. He had tried to make them conceive flux—flux which had been a greater bane to the science of illumination than anything else. Light had been known to everybody. The first thing that was ever worshipped was the sun, or the light source; the people did not worship the flux. [Laughter.] When people went into an artificially lighted room, in their quiet way they worshipped the light source; they did not think of flux. If they tried to impress flux on the average mind, there would be some difficulty. Mr. Trotter's object was to him one of the most gratifying things—that was simplification. It was the people that illuminating engineers had got to interest in illuminating science. They had their preconceived ideas. They talked about candle power; and they looked upon a source as having a certain amount of candle power. Candle power was here; and in this country and in many others it had come to stay. With regard to the lumen, there was no doubt that had got to come among scientific men; but they would never sell gas-lamps or electric lamps to produce so many lumens.

Mr. F. W. Goodenough said he did not feel competent to take part in this learned discussion. One thought that crossed his mind was the difficulty in regard to luminous intensity. Mr. Paterson had suggested "luminous strength," or "luminous capability." It struck him (Mr. Goodenough) that "luminous power" would be an acceptable expression. That would keep them very near the ordinary expression.

Professor W. C. Clinton, on the whole, considered the idea of luminous flux was rather more simple than the idea of a source with candle power associated with it. He believed that people thought more of luminous flux than they did of candle power from the source. It was much easier to think of the total flux emanating from a source than of candle power.

Mr. Edward Allen (Liverpool) said the paper was a very valuable contribution to the literature of photometry; and it appeared to him to demonstrate most distinctly the value of the Society. As those present were aware, there was an attempt to arrive at international unity in this matter of the measurement of illumination; and the British members of the International Committee would value this paper very much in considering what their attitude should be at the next conference. Just lately some consideration had been given in the House of Lords as to how to get rid of candle power applied as a standard to gas; and he was glad to say that, so far as that was concerned, candle power was not now considered to be of importance.

Mr. K. Edgcumbe was not quite clear from the paper as to how far this suggested change of definitions would affect the man in the street—the man who was the real master in this matter. If, in trying to sell a lamp, they had to speak of "solid angular flux density," he was afraid it would be a matter of some difficulty, and somewhat disconcerting. Personally, he much preferred for practical purposes to begin with candle power. But, from the scientific point of view, he was rather inclined to fall into Mr. Paterson's lap.

Professor J. T. Morris strongly agreed with Mr. Trotter's idea of simplicity of units, and favoured units which the average man could understand, because he believed it held back development very largely if the man who had to use a thing did not understand

the units about which they had to speak. But though agreeing with Mr. Trotter's desire for simplicity, he confessed, like Mr. Edgcumbe, that Mr. Paterson rather carried him with him in his idea of flux coming into their units so often.

Mr. W. J. Atkinson Butterfield said he should like a little longer to crystallize his ideas on this matter. When Mr. Trotter read his paper, he (Mr. Butterfield) was thoroughly at one with him. Mr. Paterson half converted him to his point of view; but when he said that candle power was indefinite, and that it was necessary to say "the candle power of so many candles" to make the expression complete, this reminded him (Mr. Butterfield) that there was no mention among the definitions of the old expression "illuminating power." To it there were many objections; but, on the other hand, they would not have the tautology if they said "the illuminating power of so many candles." It was an objectionable term in some other respects. He would also ask whether "illuminative value" was not a good alternative to luminous intensity or candle power. It was an expression that, he believed, originated with Dr. Vernon Harcourt—a thinker of the old school. There was something to be said for the use of the words "illuminative value of so many candles."

Mr. J. Darch advocated something terse in the nature of units and definitions for the ordinary engineer.

Mr. W. J. Liberty hoped that Mr. Trotter would give a little kindly feeling to the luminous value of the light or lamp from the commercial point of view.

Mr. V. H. Mackinney thought he should side with Mr. Trotter if he went to the public with the view of explaining the possibilities of good lighting. Then he should agree with Mr. Paterson if he wanted to take up the discussion on a technical basis with his colleagues.

Mr. Bentell could not see any objection to the notion of flux. They were all familiar with it in scientific calculations of every kind; and they were also well acquainted with light intensity. He was inclined to "side with both sides." [Laughter.] He could not see any reason for doing away with the candle or the lumen. He should be sorry to discard either. He had been giving consideration to a subject which was not likely to simplify matters, but rather to confuse them. It was that some day they might require to measure illumination subjectively, and not objectively. They must not forget that it was the eye that was the ultimate photometer. It was the eye that eventually and ultimately judged the brightness of illumination; it was the only judge for which they were catering. For this reason they might have to measure illumination subjectively.

Dr. Arthur Schuster (Secretary of the Royal Society), also in a communication, concurred with the general principles Mr. Trotter had embodied in his paper. He thought it was a good principle not to define too closely words which were in common use, unless the question of measurement came in. Strict definitions, however, were necessary in all conceptions which were to be reduced to measurement. They were to be avoided where they only aimed at substituting an uncommon word for a common one. Take, for instance, the first definition quoted in the paper: "Luminous flux is radiant power evaluated according to the capacity to produce the sensation of light." The reader was here supposed to be ignorant of the meaning of "luminous flux," but to have an accurate conception of "radiant power." This did not seem to him to be very helpful. He agreed further with the author's treatment of candle power; and he could see no objection to the use of the word "candle" as a unit. The only object of language was to make one's meaning clear to others; and once a term was properly understood in a definite sense, it was no use to enter into an etymological inquiry whether the word was really an appropriate one. It was all a question of policy, whether it was better to invent new words or to alter the meaning of existing ones. In the use of light, they wanted to retain a word which had a physiological, a physical, and a technical meaning, and its use was so common that a strict definition of its meaning would have no chance of being adopted. In the use of "candle," there could be no confusion; it was a short and very convenient word. As to the use of symbols, he added that abbreviation by initials was rapidly becoming one of the most irritating incidents of life.

Dr. H. Bunte (Karlsruhe) pointed out [in a communication at this stage] that the American proposals were in agreement with the conclusions of the International Electrical Congress, held in Geneva in 1896—that the flux of light should be regarded as the fundamental quantity, and the candle power and illumination derived therefrom. Mr. Trotter recognized that there was nothing to be said against the American proposals on the ground of logic and precision; but he contested their practical value, and endeavoured to show that the candle power was scientifically desirable, and from the practical standpoint was decidedly preferable, as the fundamental quantity. He agreed with Mr. Trotter that light should not be defined as a purely subjective phenomenon. As a matter of fact, light rays constituted radiant energy, and followed all the laws by which such radiation was governed. It was only the physiological effect of the sensation of light that was subjective; and this should be made quite clear. On the other hand, he did not agree with Mr. Trotter when he took exception to the Blondel system, as embodied in the American proposals. Their object was to lay the foundations for international agreement on a purely scientific subject, and to bring about clearness in the technical expressions involved, so that they might be intelligible alike to scientific men and those engaged in the industry. In this case, the impressions of the layman and the convenience of practical men occupied a secondary position. Yet no special difficulty would be experienced by them as a result of the proposed understanding; for their methods of measurement would remain the same as before. To understand the new method of presenting the photometric qualities was by no means such a difficult process as Mr. Trotter seemed to think. A fact that would hardly be disputed was that the use of the flux of light could not be avoided in the scientific treatment of photometry. If they assumed the flux of light, the conception of the intensity of light followed naturally. This conception of the intensity of light was thus somewhat different from that which the practical man designated as "candle power;" but the definition gave, in his opinion, the only means of bringing the photometric quantities into relation with one another on a satisfactory basis. He (Dr. Bunte) was therefore in complete accord with the Blondel system as the basis of international agreement, and as embodied in the American proposals.

The President, when closing the discussion, thought that both Mr. Trotter and the American Committee were justified in starting from the candle.

Mr. Trotter confessed that, while he had not been converted by the discussion, Mr. Paterson, Mr. MacKinney, and others had made out a good case for a two-fold consideration of the question—the aspects of the public and of scientific men. Professor Blondel spoke of two aspects—the scientific and the international. The international one would have to be considered before long; and Professor Blondel assumed the scientific basis would be adopted. But he (Mr. Trotter) did think that for practical and commercial use, it would be best not to confuse the public and architects with unit definitions which were difficult to grasp. Regarding luminosity, Mr. Butterfield suggested the use of illuminating power; and although "power" could be defended etymologically, perhaps "value" would be better. "Illuminating value" or "luminosity" would both be good words to use. As to flux, although Mr. Paterson had given analogies from other branches of physics, it was a question of expediency from the practical point of view. Dr. Bunte had rather blamed him (Mr. Trotter) for taking the practical against the scientific point of view; but he (Mr. Trotter) would be very sorry to read a paper pitched in a low key scientifically. He still felt that lumens should have a permanent place in their definitions. The expression proposed by Mr. Paterson "intensity of flux incident on the surface" was quite good. They would never get away from their conception of intense light and intense brightness. The expression that Mr. Goodenough used "luminous power" showed that many of them were thinking in the same direction. Professor Clinton held with Mr. Paterson and Professor Blondel that flux was more simple. From the mathematical point of view, perhaps it was; and, after all, they were dealing with problems that had to be considered mathematically and scientifically. Professor Morris thought that these considerations might hold back development if people had to understand these units. His (Mr. Trotter's) object in trying for simplicity was to make the thing popular.

"Transactions" of the Institution of Water Engineers.—We have received Vol. XVIII. of the "Transactions" of the Institution, containing the reports of the summer and winter meetings held last year under the presidency of Mr. Charles Clemesha Smith, M.Inst.C.E., the Water Engineer of the Wakefield Corporation. The proceedings at the two meetings were noticed in the "Journal" at the time; but the papers are fully illustrated in the volume under notice. An account is given of the visit of the members to the Wakefield Water-Works, &c., a description of which had been prepared by the President. In addition to the technical matter, summaries of the contents and indexes to the subjects in all the volumes are given. The list of the Council, Officers, and Past-Presidents, and a statement of the accounts for the year, make up the contents. As usual, a portrait of the President serves as a frontispiece. The volume has been produced under the editorship of Mr. Percy Griffith, M.Inst.C.E., F.G.S., the Secretary of the Institution.

Literature of the American Commercial Gas Association.—We have received from Mr. Louis Stotz, the Secretary and Assistant Treasurer of the American Commercial Gas Association, two interesting booklets they have prepared to assist in their propaganda work. One sets forth what the Association does for its company members, and emphasizes the fact that the services of a large organization of nearly 300 company and 2800 individual members which has steadily kept in the vanguard of gas progress, are at the disposal of those who wish to avail themselves of them by joining the body. With a growth in membership, its service will improve; and an appeal is made for support to enable it to enlarge its sphere. The booklet contains a list of company members (arranged by States) on March 1 last, and an alphabetical list of manufacturers. The other pamphlet is entitled "Opportunities in the Gas Business," and it indicates the advantages of individual membership of the Association. They are briefly put as follows: (1) The supply of general news of the industry, including editorial notes, &c.; (2) technical information; (3) employment; (4) education; and (5) convention privileges. Details in each of these points are furnished. The pamphlet should prove very useful in developing the commercial side of the gas business.

HIGH-PRESSURE GAS SUPPLY AND REINFORCEMENT, AND LOW-PRESSURE STANDARDIZATION.

By B. F. Botwood, of Birmingham.

[A Paper read before the Midland Junior Gas Association.]

It is not within the scope of a paper such as this to discuss the question of high-pressure gas supply at length. Therefore I intend to touch upon one or two details as regards the laying and fitting-up of wrought-iron mains in Birmingham during the past two or three years.

A Main-Laying Example.

The first main I shall deal with is an 8-inch and 6-inch main running through Icknield and Pitsford Streets and Western Road. The main was laid to give an industrial supply to two factories—viz., a metal works and Thomas Piggott and Sons, the well-known structural engineers. It consisted of a pipe-line of 320 yards of 8-inch and 952 yards of 6-inch wrought-iron main, the laying of which occupied 27 working days, or an average laying of 47·1 yards per diem, including fitting-up of valves, syphons, expansion joints, &c. The tube used was of steam strength, wrapped with brattice cloth and coated with composition. The sockets were of Stewart and Lloyds' tapered screw pattern. Great care should be taken in screwing the pipes home that the threads are properly engaged and well covered with manganesite or some other reliable jointing paste mixed to a moderately stiff consistency. Carelessness in this direction will only result in bad tests and the waste of time and labour engendered in remaking the joint. After the joint has been tested, the sockets are wrapped with brattice cloth and then coated with bitumen.

The 6-inch cast-iron syphons used were not fitted with loose covers, as in the larger sizes, but cast in one piece; the top of the casting being provided with a boss or centre-piece to allow the attachment of a hydrant valve for clearing the products of condensation. All valves are of the worm-and-rack type, double flanged and faced. The ends of the valve-spindles are provided with a cast-steel false top, which is secured to the spindle proper by a set-screw. The size of square on these attachments is to a standard, and allows for one key suiting any diameter of valve. This is an advantage, inasmuch as a variation in the size of spindle squares will, sooner or later, lead to confusion. Further, all valves for high pressure are so made that when the spindle is rotated "with the clock" the valve is closed.

The expansion joints used were of cast iron, and are shown in fig. 1 fitted to a syphon. The joint consists of three pieces, A, B, and C; the first portion A being formed to allow for the making of a $\frac{3}{8}$-inch high-pressure lead joint round the wrought-iron pipe, and the second B for the reception of graphite packing and the gland C. Any escape of gas, caused by expansion or contraction, passes into the annular space round the pipe in the portion B, and thence away through the outlet-boss to a rotary meter, the outlet of which is connected by 1-inch tube to the nearest low-pressure main.

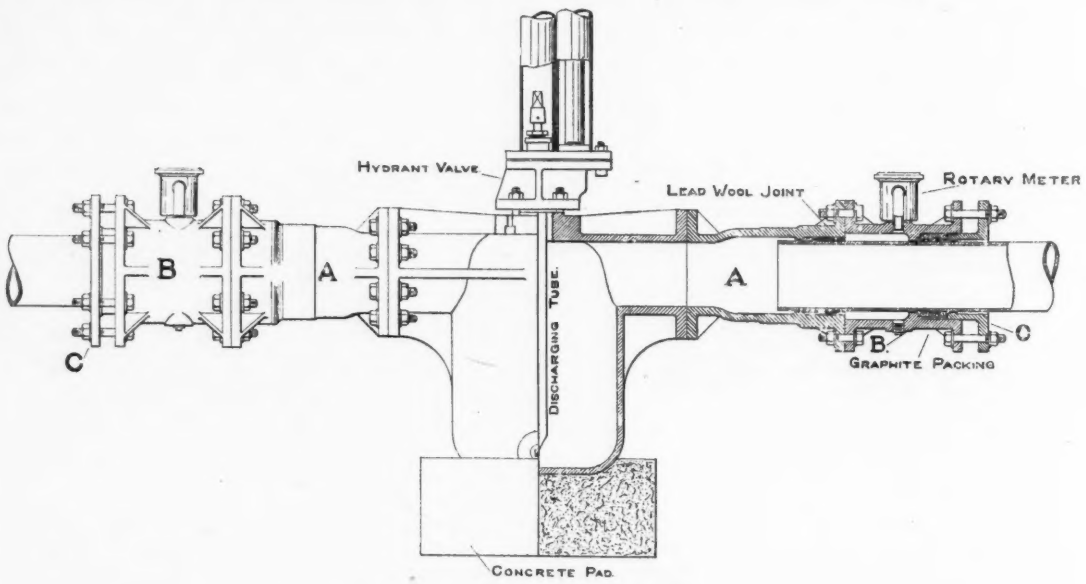


Fig. 1.—Cast-Iron Expansion Joint.

The joint between the flanges is made with a Taylor joint-ring of corrugated copper, well "buttered" with jointing paste. Grease packing should not be used in the gland joint, as the action of the gas causes it to deteriorate, while graphite will remain sound for a much longer period. This remark also applies—and perhaps more especially—to the gland packing in valves for high pressure, where it is in contact with a gas of more or less a dehydrated nature. I should also suggest that all expansion joints are boxed-round with an annular wooden box to free them from the weight of superimposed earth, and to render periodical inspection easy.

The rotary meters are, of course, covered with an ordinary lock box, and are very carefully read for leakage from time to time.

Service Attachment.

With the laying of wrought-iron mains came the question of service attachment; and, after one or two experimental models had been made and tested, a service clip was designed in the distribution drawing office which has proved efficient, both as regards ease of attachment and cheapness. The clip, as will be seen from fig. 2, takes the form of a rectangular boss having wings on either side, the lower extremity of which are screwed to allow for bolting to the under plate. The underside of the rectangular boss is machined to a radius of $\frac{1}{16}$ inch larger than that of the main, to allow for the joint.

The brattice covering of the main is cut away and the surface well cleaned; the joint being made with sheet lead, which is bedded in manganesite jointing paste. The clips are drop-stamped hot from strip iron, of a tensile strength of 26 to 32 tons per square inch; and, after screwing and machining, they are bent to template. The radial face and top face are not bored and planed, but milled with a radius and circular cutter respectively, which ensures a surface free from tool marks. This is an important point, as it is essential that there should be an absolutely "fair" surface, to avoid leakage. The under plate of the clip is an ordinary forging, and does not require any description here.

The under-pressure ferrule tap (also shown on fig. 2) consists of a cast-steel body A, a steel main plug B, a removal gunmetal plug C, a gunmetal union D, a backnut E, and a cap F. The plug C has square and tapped holes provided for engaging the operating tool G.

When running a service, the procedure is briefly as follows: The main is stripped of its covering, and the clip bolted on. The underside of the drilling-tackle bed is provided with a rectangular rubber pad, which makes a gas-tight joint with the machined top face of the clip. The drill-spindle works through a gland; and the base of the drill-gland is provided with a gate-valve. The drills used are of the cup variety with tap combined. When the clip and main have been drilled, the drill-spindle is run back until it is clear of the gate-valve, which is then closed. The top of the machine is swung over, the drill removed, and the ferrule tap plug B, with C, inserted with a yarn grummet well smeared with some graphite paste on the underside of the hexagon. The valve is then opened, the plug screwed home into the main, and the drilling tackle removed. The body A and union D are then attached, and the service run from the outlet of the body. When ready for "gassing," the operating tool G is locked on the top of the body A, with a bayonet catch. The centre spindle is engaged in the square hole in the plug C, which is then screwed back into the top of the body A, as shown in fig. 2. The backnut E and cap F are fixed; the latter being first filled with Russian tallow; and, lastly, the wrapping and coating of the main and ferrule tap are completed, and all the joints tested. Before filling in the ground,

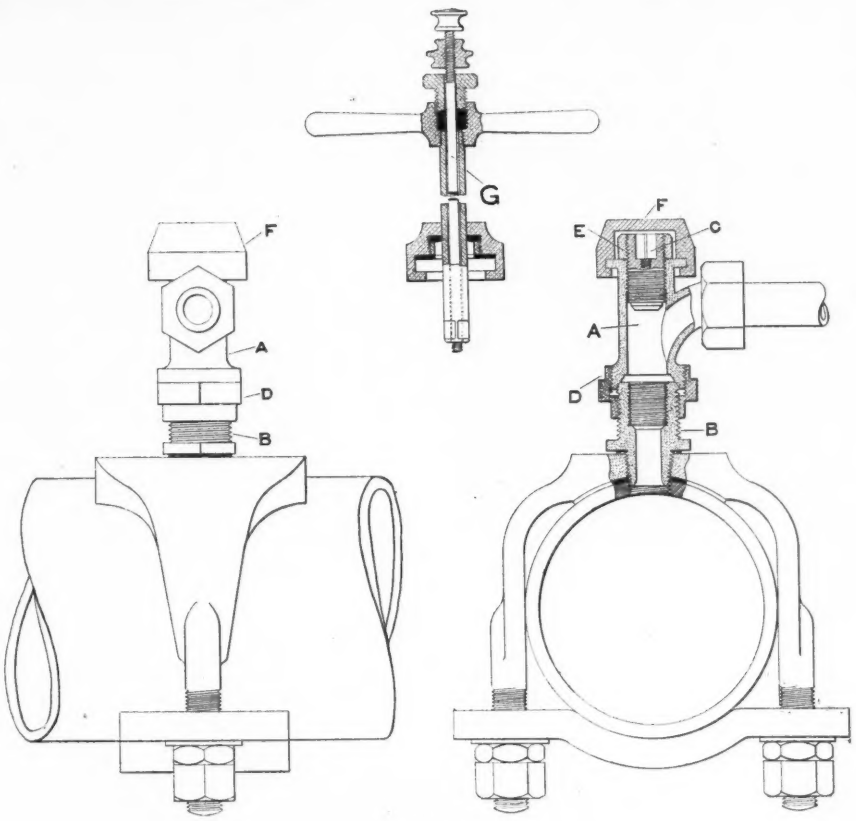


Fig. 2.—Service Clip.

the service is troughed and tarred. Double-faced worm-and-rack valves are fixed about 7 inches from the front of the kerb-line on all services, and are provided with a long screw on the building side to facilitate disconnecting, should the need arise.

Another Main-Laying Operation.

The next main I shall deal with is a 9-inch wrought-iron main with Stewarts and Lloyds' long-sleeve oxy-acetylene welded joints. This has recently been laid for the purpose of reinforcing a district in the south-west of the area of supply. The main supplies gas at high pressure to a governor-house situated at Harts Green, Harborne, where it is "broken down" to a district pressure. This point is about 6½ miles from Windsor Street Gas-Works, and about 3½ miles from the nearest high-pressure main—viz., the 12-inch main laid during 1910-11 for the purpose of reinforcing King's Norton and district. The governors at Harborne are 495 feet above sea-level, while those at Windsor Street works, whence the district received the greater portion of its low-pressure supply, are 353 feet above Ordnance datum. During January, 1913, portable pressure registers were fixed in this district, and diagrams taken. The minimum drop in pressure on the district was 17½-10ths and the maximum 25-10ths.

The laying of the wrought-iron main occupied three gangs, and was commenced on Oct. 20, 1913, and completed on Feb. 4, 1914—thus giving, on the whole period, a daily laying of 20·28 yards per diem per gang. The daily figure is in reality much greater, but is reduced on the whole period by unavoidable delays and cessation at times in the laying of the tube. The main was, where possible, laid under the footpath, at a depth of 2 ft. 6 in. from the surface, and the tube wrapped, excepting a portion at the spigot end and the sockets, with brattice cloth and coated with composition.

The main is divided into five sections by double-faced worm-and-rack valves, spaced as nearly as practicable at equal distances. The syphons used were of cast-iron and double flanged, fitted as usual with a hydrant valve for pumping. It has been proved in practice that the expansion or contraction of a wrought-iron or steel main is not only sufficient to seriously interfere with the working of a cast-iron valve, but in extreme cases to even fracture the body of the valve.

Although in Birmingham we have, fortunately, been free from such mishaps, it was thought desirable to safeguard the valves and syphons by "bridling" them. The bridle flange (which is shown fitted to a valve in fig. 3) consists of a gland-shaped wrought-iron forging 2 inches thick, the centre of which is bored out to the internal diameter of the main, and also provided with the same drilling as the flange it is to bed-against. The two extreme ends are drilled with clear holes for 2-inch bolts. This diameter of bolt is, of course, only true for the one size and thickness of main—viz., 9 inches internal diameter, having a thickness of $\frac{5}{16}$-inch—as the area of metal in the cross section of the two bolts should at least be equal to the area of the metal in the section of the main. These bridle flanges are fixed between the flanges of the expansion joint and the valve or syphon; the joints being made with corrugated copper rings. Should there be, through any cause, sufficient friction in the expansion joints to retard their action, the bridles would receive the thrust or pull, and by their rigidity overcome the evil. Care should be taken when tightening-up the nuts on the 2-inch tension bolts that no "pinch" is transferred to the valve or syphon flanges.

The Mode of Testing.

This main was tested to an air pressure of 30 lbs. per square inch; and for the purpose a testing plug was designed which may prove of interest to the members. A sketch of the plug is shown in fig. 4. It consists of a clip A, having trunnions forged on its

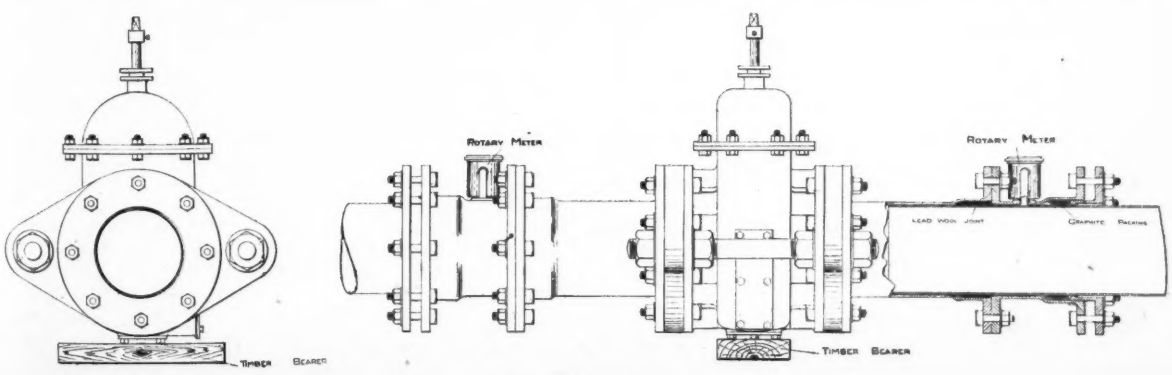


Fig. 3.—Bridle Flange.

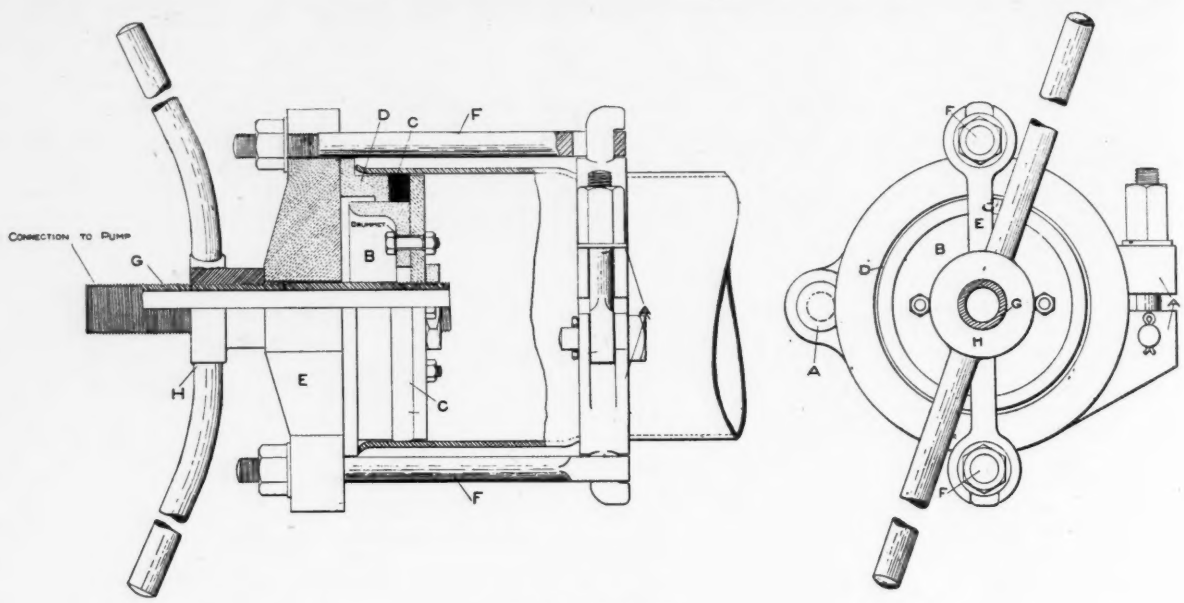


Fig. 4.—Testing Plug.

circumference, an angle ring and back-plate B, a rubber joint-ring C, a compression collar D, a cross-bar E, tension bolts F, a tension tube G (which is also used for connecting to the compressor, and a wing-nut H.

The method of adjustment is briefly as follows: The clips A are bolted round the main at the back of the socket. The angle ring and back-plate B and compression collar D, with the rubber joint-ring C interposed, is placed in the socket; and the cross-bar E is adjusted, by means of the tension bolts, to bed-against the compression ring. The wing-nut H is then screwed home, drawing the angle ring and back-plate forward towards the front of the socket, thus squeezing the rubber ring and forming a joint round the inside of the socket. The main is then pumped up to test pressure through the tension tube G. The total pressure on the face of a plug for a 9-inch internal bore main at 30 lbs. per square inch is approximately 18½ cwt.; and during one test this plug held pressure without the slightest loss for 65 minutes. The average time occupied in fixing the plug and connecting to the compressor is about 40 seconds. Care should be taken to keep the faces of the rubber ring well dressed with French chalk; otherwise it will, after a time, adhere to the metal and be liable to deteriorate.

The compressor used was of the double-acting type, direct coupled to a 15-H.P. petrol motor. The compressor cylinders are water-cooled; and under most severe conditions there has been no sign of "running hot." This machine has been in use in the city since February, 1912, and has been employed in the majority of tests since that time.

On Feb. 4, the whole length of 9-inch high-pressure main from Pershore Road to the site of the governor-house in Vicarage Road, Harborne, was placed under test. For this purpose, the compressor was stationed in the latter road and connected to the rising-pipe of a syphon. Pumping was commenced at 12.45 p.m., and ceased at 5.22 p.m., when the gauge showed a pressure of 32·5 lbs. per square inch. The total length under test was 16,109 feet.

The delivery of air was practically constant throughout the test; and 15 lbs. per square inch was reached at 2·47—*i.e.*, after 122 minutes' pumping, when the air capacity of the main was 14,320·6 cubic feet, or an added contents of 7232·6 cubic feet. This gives a delivery per minute of 59·28 cubic feet. During this period the motor main shaft was making, approximately, 520 revolutions per minute. It was not until 3.25 that the mixture of air and petrol was altered, when the pressure on the gauge was 19·6 lbs. per square inch, and the revolutions had dropped to 493 per minute. The double atmosphere (30 lbs. per square inch) was in the main at 4·57, when its contents was 21,553·2 cubic feet; the delivery per minute since 2.47 being 55·63 cubic feet. The total minutes run were 277, during which time 15,670·7 cubic feet of air were delivered—an average of 56·6 cubic feet per minute. Five gallons of "Shell" spirit and one gallon of lubricating oil were consumed. The figures given above are not corrected for temperature. The compressor is horse-drawn; but one type, I believe, is manufactured which utilizes the motor for travelling as well as for compressing—the engine being thrown out of gear at will.

The Harborne governor-house was the second to be erected of the whole of the reinforcement scheme, and the area under control of the governors meets that of the King's Norton house. The governors used are of the Reynolds-Donkin type, having an effective radius of 1½ miles. The diaphragm cases and bowls are fitted with copper vent-pipes, which are carried under the floor to the outer air, thus passing off any gas which may find its way to the upper side of the diaphragms. As this type of governor was described in the paper of Mr. James Hewett in 1912*, it is not necessary for me to explain it further.

Welded Joints.

The welded joints in the pipe-line have, so far, proved satisfactory; but before leaving this main, I would point out one or two things. Care should be taken that the metal in the joint is not subjected to too much heat in fluxing; otherwise pin-holes will form which, though easily caulked, are a source of annoyance and loss of time. The ends of the main should be left open to allow of free expansion for the contained air during welding. If this is neglected, the same trouble as with overheating will result. If it is necessary to "cant" a pipe, the "cant" should be given in the joint itself. The practice of a straight joint being made, and then the pipe being levered over in the trench, is bad, as it throws an undue strain on the jointing metal, which might, under additional shock, prove fatal to the soundness of the joint. The wire used for jointing was Swedish iron, about ⅜ inch diameter.

Testing a High-Pressure Joint.

Owing to the amount of discussion which has taken place in the Technical Press of late with regard to high-pressure joints, I will describe a test which was carried out at Nechells Gas-Works; the joint under test being a 4-inch spigot-and-faucet joint made by the British Mannesmann Tube Company. The socket joint was of lead wool backed with yarn. The effective length of the tube was about 14 feet; the joint being situated 6 feet from the end. After jointing at the Landore Works of the Mannesmann Company, a permanent set had been given to the tube of 1 ft. 11¼ in.; the pressure being applied 10 inches in front of the socket. On testing the joint at Nechells, it was found to be leaking. The lead had not been effectively caulked, so the joint was reset, though no more wool was used; and the following test was carried out. The tube was supported at two points 10 ft. 7¾ in. apart; the joint being 4 ft. 2½ in. from one of these points. A load of 21 cwt. was slung from the tube; the slings being 15½ inches on either side of the original point where force had been applied. Owing to the load, a deflection of 1⅛ inches was obtained, and while in this condition the joint was tested and found sound under an air pressure of 40 lbs. per square inch. The tube was unloaded and laid on the ground. Force was then applied with a jack to the point 10 inches in front of the socket, in order to draw the joint; and a deflection of 1¼ inches was obtained. The joint was tested under this stress, and again when it was removed, to 40 lbs., and found sound. The set of 1¼ inches was not permanent; the tube recovering its original position. The packings against which the tube bedded during this test were 3 ft. 3½ in. apart. These were now moved to 10 ft. 6 in., and a permanent set of 5¾ inches, in addition to the original one of 1 ft. 11¼ in., was given to the tube with the jack. The joint still remained sound, and was then again loaded with 21 cwt., and repeatedly struck with a hammer while under the pressure of 40 lbs., but maintained its soundness. Owing to the "jacking," the tube was crushed in at the point of application for a distance of $\frac{13}{16}$ inch—giving an external section of $3\frac{5}{16}$ in. by 5 in.

In consequence of the reconstruction of one of the Southern main roads, it has been found necessary to alter portions of the 12-inch reinforcing main to King's Norton; and one section of about 383 yards will be laid with Mannesmann tube having these joints, while other sections will be with Stewarts and Lloyds' long-sleeve welded joint.

* See "Journal," Vol. CXVII., p. 288.

Importance of Correct Record Work.

Before leaving the question of high-pressure distribution, I should like to point out the great importance of correct record work as regards the drawing and costing offices.

During the laying of any high-pressure pipe-line, a draughtsman visits the job at frequent intervals, and takes dimensions from two or three fixed points. These are transferred from the rough sketch book to a record book which is kept in the office; and the system enables any joint to be found immediately without unnecessarily breaking-up a lot of ground or paving. Valves and syphons are dealt with in the same manner, with this exception. A small sketch is made of each which gives its "dead" position with reference to the nearest building; and these are filed in a "loose-leaf" pocket book, which has also a small key plan on which are the reference numbers for each sketch. Should the need arise to shut-down any valve, the valve-man is thus enabled to have a comprehensive view of the supply affected. Furthermore, during the winter months, when there is a possibility of valve and syphon boxes being covered with snow, such dimensions are an absolutely essential feature in the supervision of a high-pressure distributory area. All high-pressure mains are plotted on Ordnance maps to a scale of 1-2500th, and points which are detailed in the record books are referenced to the book and page. It is thus possible to immediately find a correct detail of the main at any point.

As regards costing, all materials used are entered on sheets which are afterwards bound in a "Kalamazoo" loose-leaf ledger. The sheets contain all particulars as regards order numbers, stock book folios, rates, &c. These are checked either by the inspector in charge of the work or by the drawing office. After pricing, the sheets are headed with a brief note giving the correct designation of the main in question.

Low-Pressure Castings Standardization.

I will conclude with a brief description of the system followed in this city as regards the design, ordering, and stock maintenance of low-pressure castings. Prior to the introduction of the standard sheet, there was considerable variation in the dimensions of castings, which was not only confusing when planning any intricate connection, but led to loss of time when ordering.

During 1911 and 1912, the question of adopting a standard was considered; and it bore fruit in March, 1913, when the present standard low-pressure casting sheet was brought into operation. It comprises the dimensions of every casting in use in the main-laying work of the department—bends, tees, branches, crosses, well-pipes, syphons, reducers, service connectors, caps, clips, collars, and saddles. The total of the different sizes of castings falling under these heads is 670. One of the main features of the sheet is that every casting has a separate and distinctive letter and number; the letter indicating the type, and the number the size. With this system, when ordering, the distinctive letter and number are quoted; the order being afterwards checked in the drawing office, where a record of it is entered. Labour is reduced to a minimum in this way, and an unnecessary repetition of drawings avoided.

The stock of castings and pipes of larger diameters is taken every fortnight, and entered on a special stock sheet which is filed in the office. Prior to the commencement of a large main, these are referred to, and the material required "ear-marked." In this way, the stock is kept to a reasonable amount, and the possibility is obviated of a large number of castings lying idly deteriorating on the pipe-ground.

Designing Castings.

The design of castings is ruled by set formulæ, a few of which I will describe. In the case of bends, the radii were settled to obtain economy in weight while preserving flow. The length of the bend is arrived at in the following manner: The included angle of the bend is subtracted from 180°, and the remaining angle divided by 2. The tangent of this is then multipled by the radius in inches; and the dimension thus obtained is the length from the centre of the casting to ½ inch at the back of the socket's back belt. For the socket end, the length of this belt, *plus* ¼-inch is added; and for the spigot, the depth of the joint space *plus* 1 inch. The longest bend ever used is a 48-inch diameter bend (6 ft. 7 in.) having an included angle of 135°; and the shortest, a 3-inch diameter bend (1 ft. 4½ in.), with an angle of 174⅜°. The radii of these are 3 ft. 8 in. and 7 ft. 6 in. respectively.

Branches are treated in a more simple manner; and I can best illustrate this by briefly giving the working-out of a 6-inch on a 12-inch socket on a socket-and-spigot branch. The sides of the outlet of all branches are given a standard curve of 6 inches along the linear axis—the sweep from the back of the outlet socket to the periphery of the pipe naturally varies with the diameters. Taking the socket end first, the calculation is as follows: Half diameter of outlet = 3 inches, thickness of metal = ½-inch, standard radius = 6 inches, approximate fillet at back of back belt of 12-inch socket = ½ inch, length from back of belt to inside of socket = 3½ inches. Total from centre of outlet to inside of 12-inch socket = 1 ft. 1 in. The spigot end is longer on account of jointing—viz., half diameter of outlet = 3 inches, thickness of metal = ½ inch, standard radius = 6 inches, allowance for swing of jointners' hammer = 1 ft. 3 in., depth into 12-inch socket, *plus* 1 inch = 5 inches. Total from centre of outlet to end of spigot = 2 ft. 5½ in. Distance from centre-line of the 12 inches to the inside of the socket of the 6-inch outlet is governed by the addition of the half diameter of the 12 inches, the standard 6-inch radius, the socket fillet, and the back belt on the 6-inch socket.

Crosses and tees are worked out in the same manner. Reducers have a standard angle of reduction, while syphons are based on their capacity. Service connectors are now used in all 3 and 4 inch mains when running a large supply to a terrace, and where the tapping of a hole in the existing main would unduly weaken it. They are of two varieties—socket and spigot and double socket—and have a boss cast on the side with a cored hole. These holes are rimered and tapped in the works; and when a terrace main is being laid, the connection can be quickly made with a long screw. This, of course, supersedes the older method of fixing an ordinary branch and having a lead joint between the cast and wrought iron mains.

The length of this paper precludes the possibility of going deeper into the matter; but I trust I have explained sufficient of low-pressure standardization to prove it is a thing to be considered from the standpoint of labour saving and commercial economy.

DISCUSSION.

The President (Mr. W. H. Johns, of West Bromwich) remarked that the paper was a statement of the author's experience with regard to work he had carried out under the supervision of Mr. James Hewett, the Distributing Engineer of the Birmingham Corporation Gas Department. They were much indebted to Mr. Botwood for the work he had put into his excellent paper.

Mr. W. Lycett (Birmingham) said the contribution would be found useful to the gas industry generally, and especially to those engaged in distribution work. With regard to high-pressure distribution particularly, they were constantly faced with problems which had to be mastered; and the paper dealt with some of the questions that would be met with. There were one or two points on which he would be glad of further enlightenment. In the first place, how many sockets, or what percentage of sockets, did the author find faulty? With reference to the welded joint, it seemed to him that it was a very good one. He did not, of course, know whether it was the last word to be said on jointing; but would it not prove a difficult and expensive joint in connection with (say) the alteration of a road, or taking out to make alterations in the main itself? Would it not also be very awkward to re-make the joint if it cracked? He thought having to take it out would add greatly to the cost of work. Was it not possible for a flange joint to be used, properly milled, to make a sound joint? This would be more easy for taking out and altering, and should take a less number of expansion joints. He would be glad to know what was the usual distance apart to put in these joints in different sized mains. With regard to the service attachment, the weakest part seemed to be the steel nipple. Why could not the union joint be brought down to the shoulder to strengthen it there?

Mr. N. B. Hodgkin (Birmingham) remarked that the author had had a great deal of experience with high-pressure work. Under Mr. Hewett, he was trying to solve many problems that arose; and probably in the near future they would have another paper from him. With regard to oxy-acetylene welding, he would imagine that there would be a certain amount of crystallization at the point where the oxy-acetylene joint was made. Was it so? Also would Mr. Botwood tell them what was the composition used in connection with the coating of the brattice cloth; and when he said the threads were well covered with manganesite "or some other reliable jointing paste," what were the other pastes referred to? In a number of instances he knew there had been a lot of trouble in connection with jointing mixtures and jointing pastes; and some information as to what were the best things to use would be very welcome. As to the joint tested at the Nechells works, it seemed rather curious that a joint should be sent out for testing purposes which, when it came to be tested, was found to be leaking. This only went to prove how very particular the inspector or man in charge should be in regard to these joints. He himself had had some experience in the laying of a 6-inch Mannesmann tube in the South of England; and there they were always very particular in seeing that the knocking-up was done carefully. If the author would give them some figures of comparative cost of oxy-acetylene welding and the lead wool joint, they would be most useful. It was unfortunate that the author had not been able to include more information as to low-pressure standardization, for this was a really fine system.

Mr. L. Sturdy (Birmingham) inquired whether the author had any readings of leakages that had occurred from the expansion joints. In making a welded joint, what length could a man turn round with the tongs; and when it came to making a fixed joint in a trench, how did the underside get on? Could one make a good joint in such a position?

Mr. C. F. W. Rendle (Redditch) asked why the nuts were placed on the underside of the service clip.

A hearty vote of thanks having been passed to the author for his paper,

Mr. Botwood, in reply, said that, with reference to Mr. Lycett's query as to faulty sockets, the first length of main laid was in Balsall Heath Road; and it was tested one Saturday afternoon. It was really placed under test in order to get the ground filled in, and to test the first testing plug, which was rather different from the one mentioned in the paper. The inspector in charge of the work and himself were rather surprised to find that sixteen joints had been laid, and sixteen joints were leaking badly. They were kept busy for some time trying to see what to do; and then they left the job and went home. The joints were examined on the following Monday morning; and the trouble was found to be primarily due to over-heating of the metal. This was what he had pointed out in his paper. They got some minute pinholes in

castings in steel works; and the same thing happened in fluxing of metal. It was these small pinholes which had formed and allowed leakage. The joints were caulked, and in some places re-welded; and they proved satisfactory. There had not generally been very much trouble—a few pinholes, perhaps, in one joint out of sixteen or seventeen tested. One thing he would like to point out was that in the case of lap-welded pipes they should always be tested at the makers' works before being wrapped in brattice cloth. On the testing of the main he had spoken of, they found a great amount of air was getting away. The gauge was read, and then the main was re-pumped, and every valve closed. Then three days later the gauge was re-read over each section. In one section they found a leakage of about 49½ cubic feet per hour. This took a lot of locating; but they discovered it in the end. Under the brattice coating of the main was a small crack on the back of the socket. This was afterwards welded. As to alterations of joints, in the case of the high-pressure main, and having to cut out, it would naturally mean shutting two of the section valves and reducing the pressure, or in the case of welding, it would mean reducing the pressure to such an extent as to prevent it interfering with the fluxing of the metal. When this crack was being welded, if one watched the fluxing of the metal carefully one could see a small flame burning, as the gas was forcing its way round the metal, until the metal was sufficiently thick to seal it. Flange joints had been considered in Birmingham once or twice; but they had generally been discarded primarily on account of rigidity. With these joints there was a great amount of deflection allowed; and on the point of cost, he did not think there would be any comparison. The distance between the expansion joints ran out roughly at about 1100 feet. In regard to the under-pressure ferrule tap, there was a taper which prevented the nipple from bedding against the shoulder. Mr. Hodgkin spoke about crystallization of the metal. When welded joints were being considered, he (Mr. Botwood) carried out a test on a 9-inch pipe, which was cut into strips about 2 inches wide. The strips were placed in a tensile testing machine; and he tried particularly to break the metal at the weld, because he had the same idea as Mr. Hodgkin—that there might be a portion of the metal burnt in welding, and that it would naturally break at its weakest point. With three specimens he tried, the weld pulled away under a tensile stress of roughly speaking—taking it on the whole circumference of the pipe—about 53 tons. But the weld came away with the lip of the socket. There was a depth of weld of about ⅜ inch. The brattice cloth—which, as they knew, was practically an open canvas—was, he thought, in some cases coated with Dr. Angus Smith's solution, and in others with bitumen. There had been two jointing pastes used in Birmingham. One was the paste that was sold under the name of manganesite, and the other was a paste for a pure graphite joint. Manganesite was really graphite; but there was a little difference. It had been in use in Birmingham now for some considerable time. They had never yet discovered a leak with flange joints made on the method he had described; and so far they had had practically no trouble at all with socket joints. As to the leaky Mannesmann joint, it did seem rather strange that the firm should send out for testing a joint that was leaking; but anyone who saw the joint would not have wondered that it did leak. It had been hammered-up in a rough way, and left at that; but when it was set-up in the way in which joints were set-up in Birmingham, it stood anything that one could put upon it. No more wool was used. He did not think it would be fair to any firm he had named or to any pipe to give the members definite figures as to the cost of the joints, because there were, of course, many things which affected this. He could, however, tell them that the welded joints certainly came out moderately favourably. A question had been asked as to readings of leakage. So far the rotary meters had not been read, for the simple reason that they had not been in position long. The nuts were put on the bottom of the service clip to leave the under-pressure ferrule absolutely unhampered by anything at all; and another thing was it was found that, when pressure was applied, when the nuts were on the underside they tended to work loose less than when they were on the top. It did not involve much excavation. To strip the covering off a main, one must get the main clear; and the amount that had to be stripped for the uncovering did for the nuts to go in. So far as the underside of the joint was concerned, they never photographs taken on the pipe-line, showing the jointer at work had any trouble or any leakage at all. He had had a number of on the underside of the main making a steel joint. On the average, he should say that they could turn easily about five or six lengths of pipe in the trench. The amount of pipe that was turned was roughly speaking about 3 or 4 inches at a time.

At the recent *conversazione* of the Royal Society, Professor Leonard Hill, F.R.S., and Mr. O. W. Griffith showed the caleometer—an instrument designed to measure the degree of comfort in a room, public hall, or a factory, in so far as this depends on the rate of cooling of the human body. Comfortable conditions are indicated by gentle oscillations of the pointer—about a mean value of 30 calories per minute. A low, steady reading denotes monotony and oppressiveness; violent oscillations about a high mean value are evidence of excessive cooling by an unpleasant draught. Dr. Hill, it may be remembered, described the instrument at one of the conferences held in connection with the National Gas Exhibition last October.

GAS-COKE FOR STEAM-RAISING.

The comparative efficiency of bituminous coal and gas coke fuel for steam-raising, which was noted in the "JOURNAL" for March 3, has since been demonstrated by a series of tests conducted on Babcock water-tube boilers at an important factory in the London district.

In order to secure equality of conditions, the tests on coal fuel only and those on mixtures of coal and coke were conducted on alternate days. The tests served the double purpose of demonstrating the higher efficiency of a mixture of coal and coke combined, and the practicability of burning gas coke on a mechanical chain-grate stoker. The proportion of coke used in conjunction with coal was carefully gauged to 20 per cent. for the purpose of the tests; but this proportion is, of course, capable of wide variation to suit almost any set of conditions. The effect of introducing the coke next to the grate-bars, and under the coal, is to obtain a free access for air to the latter; while the conditions necessary for the rapid coking and ignition of the coal are not impaired, as would be the case were the two fuels intimately mixed before firing on this type of stoker. The coke used was unscreened breeze containing all sizes up to about 1 inch cube.

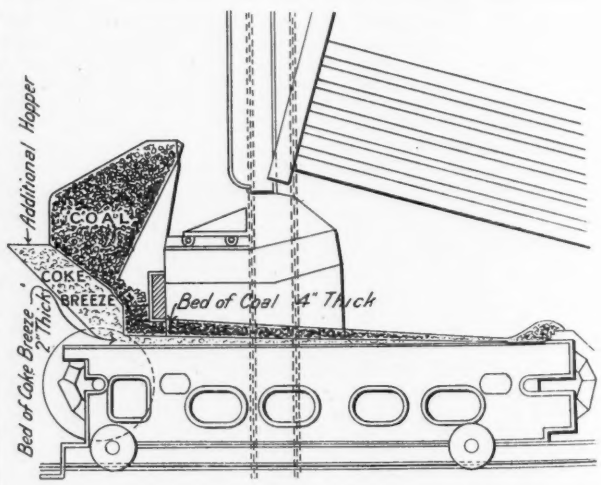
During the tests, the average temperature of the feed-water was 196° Fahr.; steam pressure, 148 lbs. per square inch; superheat, 48° Fahr.; duration of each test, eight hours.

Bituminous Coal Only.

Date.	Feb. 10, 1914.	Feb. 18, 1914.	Mar. 11, 1914.	Average.
Calorific value (dry basis), B.Th.U.	12,694	12,145	11,572	12,137
Moisture, per cent.	9	7	8·5	8·2
Coal burnt per hour, lbs	1,431	1,575	1,631	1,546
Percentage of ashes taken from ashpit	11·6	8 8	9·2	9·9
Water evaporated per hour, lbs.	9,350	11,544	10,237	10,377
Water evaporated, per lb., from and at 212° Fahr., lbs.	7·6	8·61	7·49	7·9
Average efficiency, per cent.	..	..	..	62·8

Combination of Coal and Coke (20 per cent. Coke).

Date.	Feb. 11, 1914.	Feb. 17, 1914.	Mar. 13 1914.	Average.
Calorific value (dry basis) B.Th.U.	10,382	10,075	11,370	10,612
Moisture, per cent.	8	6	8	7 3
Fuel burnt per hour, lbs.	1,612	1,601	1,780	1,664
Percentage of ashes taken from ashpit.	12·3	11·8	12·1	12·1
Water evaporated per hour, lbs.	10,312	11,146	10,245	10,568
Water evaporated per lb. from and at 212° Fahr., lbs.	7·62	8·08	6·96	7·55
Average efficiency, per cent.	—	—	—	68·7



In addition to the commercial advantage realized by using the coke mixture, the practical advantage of reducing the tendency to make smoke was a feature of the tests. The diagram shows the simple method of adapting the chain-grate stoker to burn coke fuel which was adopted for the purpose of the tests. It should be noted that the evaporative capacity of the boiler under test was increased by the use of the combination of fuel.

The annual excursion of the Scottish Junior Gas Association (Western District) took place last Saturday to Rothesay. There was a good turn-out of members and friends (the ladies being greatly in evidence). An enjoyable afternoon was spent in games in the "Meadows." After tea had been served in a local restaurant, the company betook themselves to sightseeing and rambles. Mr. Thomas Carmichael, the new President, did much to make the outing successful.

REGISTER OF PATENTS.

Gas-Flashing Apparatus.

JACKSON, T., of New Cross, and RAMSAY, A., of Folkestone.

No. 9640; April 24, 1913.

This advertising gas-flashing apparatus is intended for obtaining multiple effects of great variety in a simple and inexpensive way from from one motor mechanism. In patent No. 20,368 of 1911, there was described a motor apparatus by which double light flashing effects could be produced by one motor mechanism; and the present invention is an improvement by which sequential effects in considerable variety can be produced by the addition of very simple arrangements to the motor mechanism.

The patentees mount a number of the valve devices upon the movable part of the motor; each device having an independent angular disposition or arrangement of its parts, so that the time of passing a position of unstable equilibrium in the stroke of the motor mechanism can be predetermined at a given point of the stroke. Alternately, they arrange the series of rocking valves in a common valve-box so that the angles of the valve seats to one another, or the shape of the rolling surface of each rocking valve relative to the seats is such as to obtain sequential action in series in any number, or action partly in series and partly in parallel as desired.

Catalytic Combustion of Gaseous Combustibles.

SCHMIDT, L., of Düsseldorf, and KRIEGER, F., of Berlin.

No. 9678; April 24, 1913. Convention date April 24, 1912.

The patentees remark: In the mode of heating which has become known as surface combustion, a material which is very poor in catalytic substances is used, and the gas and air are forced through this substance in the mixed proportion requisite for complete combustion —necessitating special precautions not only for the safe production of the mixture but also for supplying it to the surface, which may be that of a hollow body, on the outer face of which it is to burn.

According to the present invention, they say, a special adjustment of the proportion of fuel to air and the aforesaid precautions are avoided by the use of a material which is primarily a catalyst; so that the combustion is due in much greater degree to catalytic action than to surface action. This mode of producing combustion has the further advantage that the material on which the combustion occurs can be much less dense than that found to be essential for surface combustion.

It is of the essence of the invention that a refractory material is used of sufficiently porous character to permit free passage of gases under pressures at which they are normally supplied to consumers or for public lighting, and that this material should contain the catalytic substance. The invention is, of course, distinguished from the ordinary incandescence gas-mantle which it has been proposed to impregnate with catalytic material; for this mantle is suspended in the flame of the burner, so that the combustion is within the mantle and not on the surface of it.

A known mode of producing catalytic combustion consists in impregnating refractory materials of the nature of earthenware, pumice-stone, clay, bricks, or the like with a catalytic substance, heating the material, and then exposing it to a jet from an air-gas burner. This mode does not, however, involve the passage of the gas and air through the catalytic material, but merely over the surface of it. In their experience "such catalytic combustion is wholly incomplete."

The invention consists in the combination of an air-gas burner (such as the ordinary bunsen burner) with a hollow body constituting a closed extension of the burner tube and made of highly porous refractory material, such as closely woven asbestos, which has been impregnated with a catalytic material—for instance, by saturating it with a solution of platinic chloride and subsequently heating it. The gas which issues from the burner tube has no passage for escape save through the pores or interstices of the closed hollow body, and in passing through these it enters into catalytic combustion, which becomes complete on the outer surface of the hollow body, and heats the latter to incandescence. The gas does not burn with a flame within the hollow body or (provided that the gas supply is not too rapid) outside the hollow body; the best results are obtained when the combustion is entirely flameless.

A convenient form of apparatus consists of a closed hollow body of asbestos threads impregnated with catalytic material after the manner of an incandescence gas-mantle, and suspended, if it is not self-supporting, over the burner, around which it may be tied to produce a complete closure. The air-gas burner may be fed with gas under ordinary pressures, or with gas or air, or both, under higher pressures, such as are used with incandescence gas-mantles.

Controlling the Supply of Gas and Air to Stoves.

JOHN HARPER AND CO., LIMITED, and RETALLACK, C., of Willenhall.

No. 9718; April 25, 1913.

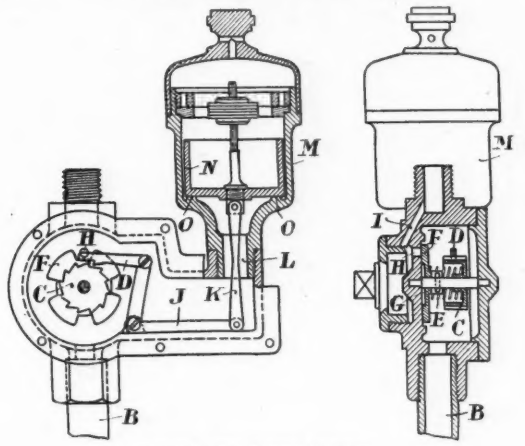
This invention relates to the type of regulator for gas stoves and heaters, in which the outlet from the gas-nozzle of the fitting is controlled by a valve operated through the medium of a turning device—such as a stud which passes through an inclined slot formed through the wall of the fitting, and in which the air passes through an opening or openings in a position to allow air passing through to mix with the gas issuing through the nozzle and to pass thence through a mixing-chamber to the burners. The object aimed at by the patentees is to utilize the movement of the turning device as it is turned to control the flow of gas, to vary also the area of opening through which the air is admitted, and to provide an adjustment whereby the area of opening for the entrance of air, corresponding to any predetermined position of the turning device, may be varied.

Lighting Gas-Lamps from a Distance.

BEHL, A., of Quedlinburg, Germany.

No. 12,699; May 31, 1913.

This is a device for lighting gas-lamps by ratchet mechanism operated by a plunger or piston for opening or closing the gas stop-cock for the gas-burner. The plunger bears in its position of rest upon a tightening ring, and in its raised position strikes against a tightening washer, in order to prevent any escape of gas around the plunger.



Behl's Gas-Lamp Lighter.

The casing of the device is connected with the gas-supply pipe B, in which a ratchet-wheel C is revolubly arranged. Upon an increase of gas pressure, the wheel is advanced for one tooth by a pawl D. A pressure-spring E intervenes between the ratchet-wheel and a turning-slide F, so that the latter is continuously pressed against the wall of the casing. Upon the rotation of the ratchet-wheel the turning-slide F is caused by a pin G to participate in this movement. Upon the latter liberating a channel H provided in the wall of the casing, the gas supplied flows through the channels H and I so that the flame burns. [The device shown is designed for an evening-flame, in which the channel H is liberated by the first pressure-stroke and again covered during the two following strokes.] To the pawl D an angle-lever J is attached, connected with a rod K which leads through the boring L of a container M, and is in connection with a plunger N which is easily movable in the container. In normal position, the plunger rests with its lower surface on a tightening plane O, so that no gas can escape around the plunger.

Carbonization of Coal.

LEWES, V. B., of Greenwich.

No. 9988; April 28, 1913.

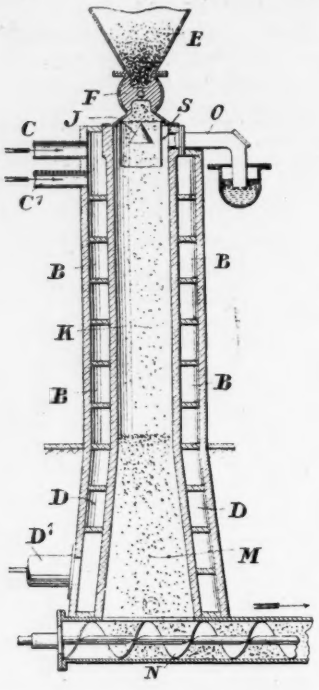
Introducing his specification, the patentee says: In processes for carbonizing coal, a common practice has been to apply the heat to the coal in mass in a retort or other chamber by conduction, in order to subject it to destructive distillation, with evolution of gas and tar vapour and the formation of residual coke. Under such conditions from 10 to 22 gallons of tar, according to the temperature and coal employed, are produced per ton of coal treated, which tar contains large quantities of pitch and heavy hydrocarbons, and a comparatively small quantity of volatile hydrocarbons.

In one variation from such practice it has been proposed to provide a vertical retort, comprising a central zone to which heat is applied, and upper and lower extensions; the coal in a finely-divided condition being, according to one method, caused to fall freely through the upper extension and heated zone into the lower extension, and well below the heated zone base, wherein the gas and coke are, before removal from the extension, so cooled as to effect condensation in the coke of the condensible products in the gas. Alternatively, it has been arranged that the residue shall collect in, and occupy a small portion of, the heated length of a retort as referred to, which residue would thus be subjected to the temperature prevailing throughout the heated zone and to further distillation by conduction. In some cases also a clear space has been provided at the top of a vertical retort, to act as a radiant-heat chamber, for the purpose of letting radiant heat act on the products after they have been distilled from the coal in mass in the lower part of the retort by conducted heat.

One object of the present invention is to so carbonize coal or shale, by such a use of radiant instead of conducted heat, that the distillation products shall comprise a minimum of heavy tar and a large proportion of light hydrocarbon vapours; a further object being to obtain from coal a uniformly carbonized residue still containing sufficient volatile matter to render it capable of being easily ignited and burnt "with a cheerful and practically smokeless flame."

For accomplishing the first object, the finely-divided coal is caused to traverse a highly-heated space in the uppermost region of the retort, wherein the temperature decreases as the residue collecting zone is approached—distillation beyond the needed degree being prevented by the coal particles entering into a lower temperature region. In effecting the second object, the partially carbonized residue is submitted to a slowly decreasing temperature initially somewhat below that needed for distillation, so as to cause the remaining volatile matter to thoroughly and uniformly permeate the mass, which latter is removed in such condition from the retort.

The light condensible hydrocarbons in the distillation products can be separated from the more permanent gas by washing the mixed gas



Lewes's Coal Carbonization Process.

and vapours with heavy oils, which, on subsequent distillation, then yield volatile spirit said to be very suitable for use as motor spirit and for other purposes.

In carrying out the invention a vertical retort is employed, by preference shorter in height than the retort ordinarily used in continuous processes; the heating chambers and flues being so arranged that producer gas and secondary air are delivered to the retort at its highest portion and caused to burn downwards. By this means combustion is completed in the flues or passages surrounding the upper portion of the retort, which is thus at the maximum temperature. Its lower limit is determined by a position where, on account of the distance from the inlet of the combustible mixture, the temperature, although still relatively high, has fallen sufficiently to prevent further distillation taking place. This selected limit coincides with the upper level of the residual mass of partially carbonized coal particles in the lower portion of the retort, which latter is surrounded by flues or passages through which the cooling products of combustion of the producer gas and secondary air are caused to pass and subject the residue to a soaking heat gradually decreasing in intensity. In this way, the remaining volatile matter (usually from 5 to 10 per cent.) "is caused to thoroughly and uniformly permeate the solid residue, and yield a homogeneous fuel of a character not obtainable with more rapid cooling." The total distance from the top of the retort to the level of the partially carbonized particles can conveniently be from 7 to 8 feet; the uppermost 4 feet, or thereabouts, being at a temperature of from 1000° to 1200° C., and constituting the most active zone of the radiant heat chamber. The lowermost portion, the top of which coincides with the upper level of partially carbonized particles, is at a temperature of approximately 400° C., and less than that necessary for further destructive distillation.

According to one example, coal is fed into the top of the radiant heat chamber, the height of which is governed by the degree of the carbonization desired, in any convenient manner, and in a finely-divided condition, whereby the most easily disengaged volatile constituents which constitute the major portion of the volatile matter are, while the coal falls through the space heated by radiation, distilled from it and escape directly upwards to an exit pipe at the top of the chamber, thus undergoing little or no secondary reactions of the kind that in ordinary carbonization form the heavier hydrocarbons, retort carbon, and pitch. The particles of semi-carbonized coal are caused to so collect in the lower part of the retort that the level of the top of the mass will be maintained at, or somewhat below, the bottom of the zone of the retort—constituting the upper and distillation chamber through which the coal falls. This level is maintained by removing the semi-coke from the bottom of the retort at a rate corresponding with the rate of feed. The hot mass still contains, as a rule, a sufficient quantity of hydrocarbons as it leaves the retort to enable it to be pressed into briquettes of various forms, "so doing away with the disadvantages of the bulky and friable character of most semi-cokes;" while, if there is not enough hydrocarbon in it, from 6 to 8 per cent. of hard pitch may be added.

The accompanying illustration shows in vertical section one construction of vertical retort surrounded at its upper portion with flues or passages B, to which are supplied combustible gas and air from the pipes or conduits C and C^1 respectively, and, at its lower portion, by flues or passages D, through which the products of combustion in a cooler condition are caused to circulate, and are ultimately discharged to a chimney by the flue or passage D^1.

Coal in a sufficiently fine state of division is charged into a retort from a hopper E by means of a rotary valve F, and is so distributed by the cone device J in the upper portion (constituting a radiant heat chamber K) as to separate effectively the particles one from another and ensure each being thoroughly acted upon. The partly carbonized residue, consisting of the treated particles, collects in the lower and cooler portion M of the retort, and is discharged from the base (say) by a conveyor N, the speed of which is so controlled that the upper level of the partially carbonized residue in the retort is approximately coincident with the floor of the lowermost of the flues or passages B.

For convenience of removal of the treated particles from the lower portion M of the retort, the latter may be made of taper formation. The gases evolved from the coal while falling through the region constituting the radiant heat chamber K are led away by the pipe O to the hydraulic main R. For preventing or minimizing entrance of the fine particles or dust into O, the upper portion of the chamber K is provided with a cylindrical shield S depending from the retort cover to a part below the mouth of the pipe, and of such diameter as to form an annular chamber between it and the retort wall for the gas to obtain access to the exit-pipe.

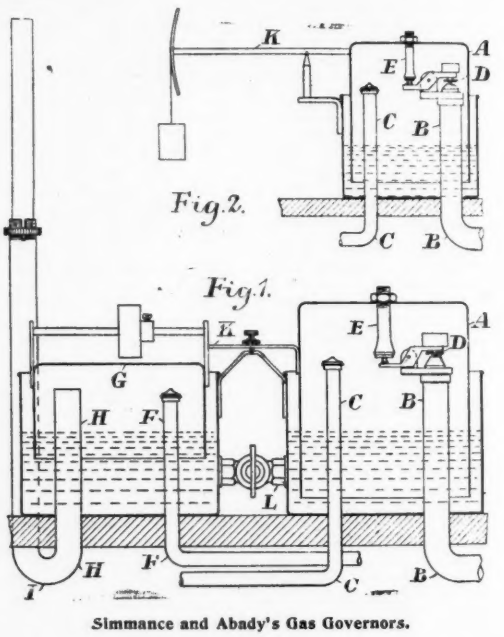
Gas Governors.

SIMMANCE, J. F., of Westminster Palace Gardens, S.W., and ABADY, J., of Fountain Court, Temple.

No. 16,029; July 11, 1913.

This invention relates to apparatus for regulating the flow of gas, the pressure or density (or both) of which may vary from time to time, so as to "obtain greater sensitiveness, and easier access to the important parts on which the accuracy and sensitiveness of the governor depend."

The governor is of the type which has a tank, bell, and liquid seal, gas supply, and discharge pipes passing through the bottom of the tank, a valve mounted on a lever inside the bell and controlling the orifice at the end of the gas supply pipe, and a stop fixed to the bell which controls the position of the valve lever. The bell is mounted at the end of a beam, suitably fulcrumed and balanced, so as to be instantly removable without disturbing any other part; while the valve and lever are placed inside the bell in such a manner that it can be instantly removed after the bell has been removed. When the governor is required to give a flow of constant mass per unit of time while the density of the gas may vary, the apparatus described in patent No. 27,484 of 1911 is employed.



Simmance and Abady's Gas Governors.

Fig. 1 is a diagrammatic view of apparatus to be used to give a flow of gas of constant mass per unit of time, when both the pressure and density of gas in the main may vary. Fig. 2 is a diagrammatic view of apparatus to be used to correct only variations of pressure in the main.

The main supply of the gas is led inside a bell A (the "main bell") sealed in a liquid contained in a tank; the supply pipe B being led upwards from the bottom of the tank through the liquid. The gas then flows by a discharge pipe C passing downwards through the bottom of the tank and on to the burner, calorimeter, or other apparatus in which it is used. The governor proper is placed inside the main bell at a convenient height above the level of the liquid. The governor valve D is mounted at one end of a governor lever, the other end of which bears against a stop E, integral with, or fixed inside, the main bell. The valve is immediately above an orifice at the upper end of the supply pipe B, and by its distance above the orifice regulates the rate of flow of the gas. The governor lever is supported on a "geometric bearing" (not shown) near the upper end of the supply pipe. [The geometric bearing is the well-known device used for oscillating levers in philosophical instruments instead of the simpler journal bearing more commonly used in mechanisms for small oscillatory movements; the objects of the geometric bearing being to eliminate friction as completely as possible, and to ensure the exact alignment of the bearing with the minimum amount of very accurate fitting.]

The apparatus for neutralizing variations in the density of the gas is arranged as follows: An auxiliary supply of the gas is permitted to flow steadily by a pipe F to the inside of a second bell G (the "density bell") sealed in a liquid, from which the gas flows by a pipe H, passing down-

wards through the bottom of a tank in which the bell and liquid are contained. The gas then passes along a horizontal pipe I, and finally escapes from the top of a long vertical pipe J.

The two bells are rigidly connected to the ends of a balance beam K, fulcrumed at the middle and provided with adjustable balance weights, by means of which any desired degree of sensibility of the balance can be obtained, and the balance adjusted for any normal density of the gas. The tanks are connected by a pipe L. Before the gas is turned on, the cock on this pipe is opened, thereby equalizing the levels of the liquid in the tanks—both liquid levels being open to atmosphere. The cock is then closed, and the gas turned on. Any upward movement of the density bell G, due to an increase of the density of the gas above its normal value, causes downward movement of the main bell A, thereby bringing the stop E into a lower position, and raising the governor valve D further from the orifice arranged at the end of the main supply pipe B.

If the regulator is to be used as an ordinary pressure governor, in which a constant volume of flow is aimed at (a constant mass not being essential), the density bell, its tank, and auxiliary gas piping are all dispensed with. In this case, as shown in fig. 2, the main bell A is connected to one end of the balance beam K, and an adjustable counterweight to the other end; so that the governor may be adjusted for any desired normal delivery pressure.

Coin-Freed Meters.

HIBBERD, C. E., of Tooting Bec, S.W., and GOAD, F. L., of Edinburgh.

No. 15,337; July 3, 1913.

In prepayment mechanism employed in conjunction with a gas-meter, it is customary (the patentees remark) to arrange the meter so that the coin compartment is separate from the price-changing gear compartment—thus allowing access to be given to the price-changing gear without obtaining access to the coins, and *vice versa*. At present the compartments for the price-changing gear and the coins are either secured by separate padlocks or locks operated by separate keys, or else the coin compartment is secured by a padlock and the price-changing gear by pins which, after being screwed home, are sealed with wax with the company's seal.

To minimize the risks of pilfering or tampering with the meter, the inventors propose an arrangement whereby access to two or more separate compartments (such as the coin compartment and the price-changing gear) may be obtained by the manipulation of different keys in the same keyhole. This is arranged for by providing a coin-box, constructed preferably of rectangular form, and divided horizontally by a partition; the upper compartment being adapted to enclose the prepayment mechanism and price-changing gear—of any well-known type having a series of wheels with numbers of teeth corresponding to the amount of gas being delivered for the coin inserted. The lower compartment provides a space into which the coins may collect after operating the prepayment mechanism. The coin-box is constructed so that the faces present no projecting surfaces which would facilitate the introduction of tools by unauthorized persons or tampering with the machine; while the upper and lower end surfaces of the coin-box are countersunk, so as to be flush with the level of the sides, and are movable or hinged so as to form lids or doors for the protection of the prepayment mechanism and coin compartment respectively.

Ovens for Generating Gas and Producing Coke.

KOPPERS, H., of Essen-Ruhr, Germany.

No. 16,318; July 15, 1913.

This invention relates to vertical retorts having in their walls horizontal heating flues communicating with regenerators, by means of vertically distributed ports—the gases flowing horizontally through the flues and regenerators. The invention essentially consists in providing at each end of the flues a regenerator chamber which is traversed alternately by hot gases and cold gases—that is to say, reversible regenerators provided with horizontal partitions dividing them into independent units through which the gases flow to and from the ports of the flues.

The regenerators may be arranged at opposite sides of the retort or oven; the heating flues forming short straight passages between them. Or they may be arranged at one side only; the heating flues passing around the oven chambers, and receiving gas and air from hot regenerator chambers, and delivering the products of combustion to cold regenerator chambers on the same side. In both cases the ports distributed over the whole height of the oven between the heating flues and the regenerators ensure that the latter are fully utilized; and the interposition of the reversible regenerators in the path of the gases is said to ensure that a horizontal direction of flow is maintained at the ends of the flues, as well as in the latter—the path of least resistance through the regenerators being a horizontal one, and the gases having therefore less tendency to take diagonal paths from and to the main inlet and outlet ports respectively.

In order to provide for obtaining different heat zones, the regenerators (in one modification) are divided at different heights into separate compartments by horizontal partitions; each compartment being capable of being independently controlled by slides, so that the quantity of air admitted from a chamber common to all the vertically disposed compartments, or the exit of the waste gases, can be accurately regulated. With this arrangement it is possible to heat certain compartments more intensely than others, by outside adjustment.

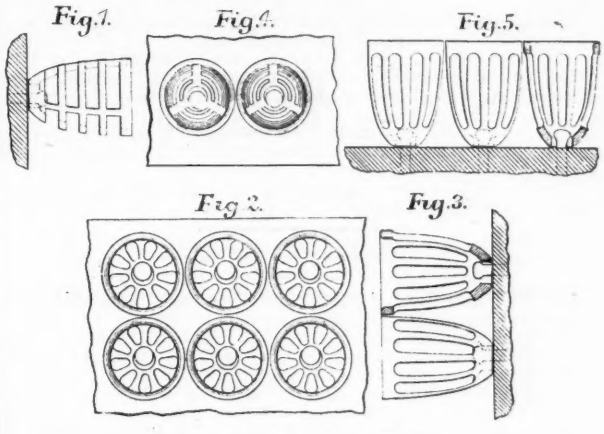
The oven or retort may be constructed for intermittent or continuous operation, and the whole arrangement is "very compact and easily inspected, particularly as regards the heating flues." The space underneath the oven is entirely free; and "the loss of heat by radiation very small."

Gas-Fires.

CARPENTER, C. C., of Old Kent Road, S.E.

No. 3297; Feb. 7, 1914.

This invention is a modification of patent No. 25,849 of 1910, the subject of which was "a fuel consisting of open work fire-clay structures of pyramidal form attached to the backing of gas-fires." According to the present invention, the fire-clay structures, instead of being pyramidal as in the previous arrangement, are circular in cross section and (in general outline) approximately conical.



Carpenter's Gas-Fire "Fuel."

Fig. 1 shows part of a gas-fire backing in section with three structures of the new form applied to it, one being in section. Fig. 2 is a front view showing a portion of the backing and six fire-clay structures fitted to it. Fig. 3 is a side view of fig. 2 partly in section. Figs. 4 and 5 are front and side views showing the fire structures differently constructed.

The structures are hollow, circular in cross section, and made up of ribs, which may extend longitudinally, as in figs. 1, 2, and 3, or circumferentially as in figs. 4 and 5. At the small end there is a hole which hooks on to a peg in the backing.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Long Eaton Judgment.

SIR,—Will you please allow me to convey the thanks of my Company to Mr. Carpenter for his generous letter published in your last issue.

So far as I, myself, am concerned any appreciation is quite undeserved.

May I be permitted to state, that in this matter we at Long Eaton especially, and the gas industry in general, are under great obligation to Mr. Carpenter for his whole-hearted and invaluable assistance "all along the line."

It is only right that I should say this.

G. STEVENSON.

Long Eaton, May 25, 1914.

Automatic Street Lighting in Leeds.

SIR,—I have been somewhat surprised at seeing the report in your paper of the 12th inst., in reference to automatic lighting in the City of Leeds.

It is a pretty well known fact that we have had for some considerable time over 1000 of our controllers in use in the city. Your report certainly makes it appear that they have only a few, and are going to try 100.

The facts are that more than seven years ago we supplied them with 86 "Gunfire" controllers, while they have now installed a total number of 1272, over a thousand of these being supplied within the last six months.

I think, in justice to us, that you should correct such a misleading statement.

JOHN GUNNING, Managing Director and Secretary.
Automatic Light Controlling Company, Limited.

Bournemouth, May 20, 1914.

[The statement referred to was supplied by a well-accredited journalist who regularly sends news items for publication in the "JOURNAL."—ED. J. G. L.]

Malta and Mediterranean Gas Company, Limited.—At the half-yearly meeting of this Company on the 9th prox., the Directors will report that the balance on the general revenue account for the year ended March 31 is £6057; and they will recommend the payment of the usual dividends on the first and second preference capital, and a dividend of 4 per cent., free of income-tax, on the ordinary capital. This will make, with the interim dividend paid last December, 6 per cent. for the year, and leave £1155 to be carried forward.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Private Bills:—

The Isle of Thanet Gas Bill, South Suburban Gas Bill, and Tees Valley Water Bill were brought from the Commons, read the first time, and referred to the Examiners.

The Market Rasen Water Bill was read a second time and committed.

The Longwood and Slaithwaite Gas Bill and Gas Light and Coke Company Bill were reported with amendments.

The Hightown Gas and Electricity Bill, Chelmsford Gas Bill, Clydebank and District Water Order Confirmation Bill, and Inverness Gas and Water Provisional Order Bill were read the third time and passed.

The Select Committee on the Kidsgrove Gas Bill reported that they had not proceeded with the consideration of the Bill, all opposition having been withdrawn. The Bill was committed.

The House was informed that the promoters do not intend to proceed further with the Mexborough Water Bill.

HOUSE OF COMMONS.

The Hightown Gas and Electricity Bill and Chelmsford Gas Bill were read the first time and referred to the Examiners.

The Skegness Urban District Council Bill, Gas and Water Provisional Orders (Nos. 1 and 2) Bills, and Gas Provisional Order (No. 3) Bill were read a second time and committed.

The Northwich Urban District Council Bill and Cleckheaton Urban District Council Bill were reported with amendments.

The Abertillery Water Board Bill was recommitted to the former Committee, and was later reported with an amendment.

The South Suburban Gas Bill was read the third time and passed.

The petitions have been withdrawn of the Hayward's Heath Urban District Council against the Hayward's Heath Gas Bill, and of Eric James Walter Platt against the Llanfaelog Water Bill.

The Skegness Gas Bill, Brentford Gas Bill, Leighton Buzzard Gas Bill, Local Government Provisional Order (No. 3) Bill, and Lurgan Gas and Electricity Bill have been referred to a Select Committee consisting of Mr. James Mason (Chairman), Mr. Barton, Mr. Kerr-Smiley, and Mr. Patrick White; to meet on Wednesday, June 10.

LEGAL INTELLIGENCE.

RIGHT TO LAY A WATER-MAIN UNDER A RAILWAY.

Metropolitan Water Board v. London, Brighton, and South Coast Railway.

This case, which was heard before Mr. Justice SHEARMAN on the 19th inst., was an appeal, by way of a special case, from the award of an Arbitrator which decided that the Board had power to lay a water-main or pipe under the railway without paying any consideration to the Railway Company.

Mr. CLAVELL SALTER, K.C., and Mr. COURTHOPE MUNROE were Counsel for the Water Board; Mr. CLODE, K.C. and Mr. CYRIL HARTREE, for the Railway Company, the appellants.

Mr. HARTREE said the point was of considerable importance to all railway companies in the district of the Metropolitan Water Board, because the Board claimed to be entitled, under the terms of their Act of 1907, to lay water-mains under any railway within their district without making any payment to the Railway Company. The Board admitted liability to pay compensation for certain specified results from the putting down of the main; but for the occupation of the land itself, they said they were not compelled to pay anything. The Board had acted under section 16 of the Public Health Act, which was incorporated in the Board's Act, which entitled them to lay mains under any lands. He contended that if the Board wanted to exercise their powers they must first acquire an easement from the Railway Company. Under the Public Health Act, if a local authority made a sewer, the land around it vested in the local authority for an estate in fee simple or determinable on the happening of an event; but at any rate an estate, and that was all he was required to show.

Mr. Justice SHEARMAN: You say that a sewer made by a local authority under the Act of 1875 conveys an estate in the land?

Mr. HARTREE: Yes.

Mr. Justice SHEARMAN: Did the Water Board give notice to the Railway Company that they intended to lay a main?

Mr. HARTREE: We gave the proper notice.

Mr. Justice SHEARMAN: And now the Railway Company want compensation for what is known as a "way-leave." Is that the point?

Mr. SALTER: The Railway Company say that the Board must buy an easement over their land.

Mr. HARTREE: The main was laid with the consent of the Railway Company, subject to a referenee to arbitration on this point. The land is situated at Battersea; and the laying of the main did not involve any change in the title to the land. The real question was whether the laying down of the main involved the purchasing of the Railway Company's property, or the taking of an easement, or the purchase of a right.

Mr. Justice SHEARMAN: The Water Board contend that they had to pay nothing for the privilege of laying the main.

Mr. HARTREE: Yes; and we contend that they must compulsorily acquire an easement, and pay for it. We are quite willing to grant an easement. He contended that the soil occupied by the main became vested in the Board for an estate; that this involved the acquisition of the land; and that it then vested in the purchaser. The Board had not acquired an easement; but they had acquired statutory property in the land. Sub-section 6 of section 96 of the Board's Act of 1907 says: "Notwithstanding anything contained in this Act, or any Act incorporated wholly or partly therewith, the Board shall not, without the consent of the Railway Company, purchase or acquire any of the lands or property of the Railway Company." That was a direct prohibition that the Board should not do it. But if the necessary result of their proceeding under section 6 was that the Board did acquire a part of the Railway Company's land the prohibition applied, and they must get an easement from the Railway Company.

Mr. CLAVELL SALTER said that if his friend was right, the question was certainly of great importance.

Mr. Justice SHEARMAN; Do I correctly understand you to argue that you need not pay even for a way-leave?

Mr. CLAVELL SALTER: No, my Lord. I say that the Board, being in difficulties as to the discharge of their public duties, when they crossed a railway they had to go to the Railway Company for leave to lay the main. Thereupon the Railway Company imposed onerous conditions. To get over the difficulties, the Board obtained parliamentary power to lay their mains through any person's private land without acquiring from that person any right of property at all—of course, paying compensation for any injury done.

Mr. Justice SHEARMAN: You must not assume that you can drive a sewer through my garden without paying me way-leave.

Mr. SALTER: My contention is that nothing in the nature of a way-leave is paid for; it is compensation for disturbance or injury. The question for the decision of the Arbitrator was: Are the Board entitled under the powers of the Act of 1907 to lay a main beneath the railway without purchasing or acquiring from the Railway Company any easement or right. There was no question in the case of compensation or its amount.

Mr. Justice SHEARMAN: Is your contention that, whatever the law may be, having laid this main under the railway, you have only to pay the Company the same compensation as a local board would pay?

Mr. SALTER: Yes; I am in the position of a local authority, and our pipes are vested in us under our own Statutes—not under the Public Health Act.

Judgment.

In delivering judgment, Mr. Justice SHEARMAN said the case involved a very nice question of construction of the Water Board's Various Powers Act, 1907. He had to see how sections 61 and 96 of that Act were to be read together. He thought the Board obtained the powers in section 61 for the express purpose of enabling them to run their pipes over or through different people's land without giving notice to treat or forcing themselves to make compulsory acquisition under the Lands Clauses Act of the property they were taking. The Water Board had run a main under the London, Brighton, and South Coast Railway at Battersea; and, in effect, the Company said that under the protection given them by the Act of 1896, the Board could not do this unless they acquired an easement under the Company's property. On the other hand, the Water Board said that section 61 empowered them to lay the main without acquiring a right. His Lordship was of opinion that section 61 gave the Board all the powers of a local authority—in fact, it gave them, in effect, the powers which are contained in section 16 of the Public Health Act. Reading section 61 alone, the Water Board would be entitled to lay their pipes through this district; and it could not be seriously argued, after the decision in the Twickenham case, that the Water Board could not lay a pipe without compulsorily acquiring any easement beforehand. Section 61 entitled the Board to run this main without acquiring any easement at all. The question he had to decide was whether under section 96 this right was taken away or qualified as regards the railway companies named in section 96. He was not at all sure that the railway companies did not make a very good bargain with the Board when they got the section. It was an extremely valuable provision. It was quite clear that section 96 enacted that the ordinary compensation clauses of the Public Health Act did not apply; but that the specific provisions of the Water Board's Act did apply. His Lordship thought the words "purchase or acquire" were used in the ordinary sense as in the Lands Clauses Act; and, therefore, there was nothing to prohibit the Board from doing what they had done under the powers of section 61. On the whole, reading the two sections 61 and 96 together, it seemed that there was nothing to prevent the Board from laying their main without acquiring an easement, under the powers conferred on the Board by section 61 of the Act of 1907. The answer to the question asked by the special case was, therefore, in the negative; and the award would stand.

Charge of Breach of Contract of Service.

The Bideford Magistrates had before them yesterday week a case in which John Crang, an employee of the Westward Ho Gas Company, was charged under the Conspiracy and Protection of Property Act with maliciously breaking his contract of service with the Company, knowing that the probable consequence of his so doing would be to deprive the inhabitants of Westward Ho and district wholly or to a great extent of their supply of gas. It was stated that defendant, who had been in the employ of the Company for about four years, had an altercation with the Manager, Mr. M. J. Ryan, on Easter Sunday evening, and after asking "Who was boss?" gave a week's notice. Crang then went away as if to light the lamps; but came back and said he would leave at once and threw his torch over the wall. The Manager called his attention to the fact that he rendered himself liable to prosecution; but Crang said he did not care. The consequence was that the lamps were not lighted for an hour or more after the usual time. Mr. Ryan, in cross-examination, said that defendant had been looking for another situation in March last, but had not given notice. He did not tell Crang to "clear out." But it was true that he asked him why he had not scrubbed the kitchen out. Mr. Goaman, for the defence, contended that the Conspiracy and Protection of Property Act was not intended to apply to a dispute of this nature, which arose out of a domestic squabble as to the scrubbing of Mr. Ryan's kitchen; and the dismissal was by Mr. Ryan, who lost his temper. The Magistrates, after hearing the defendant and his wife, dismissed the case.

MISCELLANEOUS NEWS.

LIVERPOOL FAZAKERLEY WORKS TO BE SOLD.

Corporation Agreement with the Gas Company.

At the close of an hour-and-a-half's debate, the Liverpool City Council, at a special meeting last Wednesday, agreed to a recommendation of the Parliamentary Committee that the Fazakerley Gas-Works, which are the property of the Corporation, should be sold to the Liverpool United Gas Company; the price being the amount of the net debt upon the undertaking outstanding at the end of the year.

Alderman BARTLETT, in proposing the confirmation of the recommendation that the Council authorize the Parliamentary Committee to enter into an agreement with the Gas Company for the sale of the works, said the proposed sale was not originally in the mind of the Parliamentary Committee, and they simply took protective measures in the Bill to provide against being crushed out altogether from any extension. The Gas Company, among many other provisions, asked that their area of supply might be increased by adding to Liverpool and other parts they had—Aintree, Netherton, Sefton, Lunt, Ince Blundell, and Thornton. The Corporation's powers of supplying gas were limited entirely to the Fazakerley township. They had no power to supply in Liverpool; and their only means of extending would be to take in some or all of those districts which the Gas Company sought to include in their area of supply. The Corporation felt, therefore, that they must oppose on this ground; and they did so because they felt that if they could not extend there, there would be no possibility of doing anything very much with their present limited area. The natural increase of the population of Fazakerley was not likely to lead to very much. When the Bill was gone into, one of the Company's witnesses was asked whether the effect of the granting of the additional area to the Company would not be to entirely prevent the Corporation from ever extending their area. The witness admitted this was the case, and in the course of his evidence made a suggestion that possibly a way out of the difficulty would be for the Corporation to sell to the Company their works at Fazakerley. At the close of the day, Lord Clinton (the Chairman) made a suggestion that, as they did not seem so far from each other, they might consider whether they could not come to terms. Acting upon this, they had two interviews with the representatives of the Company, and arranged the terms with regard to the points that were the most important to them both. The ultimate outcome of the matter was the recommendation before the Council. The Town Clerk had received a letter from the Secretary of the Gas Company stating that the Company were willing to accept the terms offered by the Corporation. If the proposal now made were not agreed to, the Corporation would be obliged to continue their opposition in the Commons.

Alderman SMITH remarked that no argument had been advanced why the Corporation should hand over their birthright to the Company for not even a mess of pottage. They had at Fazakerley a small gas undertaking, which had been put upon its feet after considerable labour, and which was very nearly paying its way. He admitted that there was a greater good will in the attitude of the Company towards the Council to-day than there was thirty years ago; but he had never agreed, and never would agree, to give to outside bodies, however efficiently officered, the control of any public utility that could be administered properly by the Corporation. The Corporation were now proposing to surrender their control over the only district in the city which had not come under the control of the Gas Company. He warned the Council that they were taking an unwise step, and one that would react to their detriment. He did feel very sad that all the labour he had put into the work of the Fazakerley gas undertaking should be thrown away. He had no objection to the Gas Company getting advantages which their economies might entitle them to; but he did not think they ought to get the Fazakerley gas undertaking at the price the Corporation paid for it.

Sir CHARLES PETRIE said they had had seven years' experience of the works at Fazakerley. It had not been a financial success. The increase in the gas consumption in the district had been exceedingly small; and the Council had had to contribute out of the general rate towards a deficiency of about £2500, spread over the seven years. The people of Fazakerley paid for their gas 5d. per 1000 cubic feet more than the Company were charging; and there were bitter complaints about the quality of the gas supplied. The Council now had a golden opportunity for getting rid of the Fazakerley works; and they would be at fault if they did not avail themselves of it. Alderman Smith talked as though they were giving away the works. The proposal was that they should be taken over at the price at which they stood in the books on Dec. 31 next—about £17,500 or £17,600. There was no prospect of making the concern pay any better in the future. It was too small to pay. The Council now had an opportunity of getting back their capital. He knew of no other business which had been worked for seven years consistently at a loss on which they could expect to get their money back, as they would in this case. The Company had met the Corporation fairly and squarely, and were anxious to do everything possible to meet the citizens. They really did not want the works; and he had had some difficulty in getting the Chairman of the Company to make an offer for them. The Council would be guilty of culpable negligence if they declined the Company's offer.

Mr. BLAIR, on behalf of the Labour party, moved as an amendment that the recommendation be referred back. His reason for this was that the Parliamentary Committee might consider the advisability of taking over the business of the Liverpool Gas Company. The very essence of municipal trading was that it should embrace the whole city area, so that it should have every facility of success. But Fazakerley was as yet undeveloped; and the fact that they had lost £2500 in seven years was not an adequate reason for surrendering their gas undertaking, when they considered that they would be able to supply the surrounding districts if they acquired further powers.

Mr. W. A. ROBINSON seconded the amendment. He alleged that a report had been obtained from an expert on the Fazakerley Gas-Works, which had not been brought before the Committee; and he contended that the report should be presented.

After some further discussion, the amendment was rejected by 49 votes to 11; and the recommendation was agreed to.

LABOUR CO-PARTNERSHIP ASSOCIATION.

Annual Public Meeting.

In the Central Buildings, at Westminster, last Thursday afternoon, there was held the annual public meeting of the Labour Co-Partnership Association. The gathering, which was presided over by Mr. H. G. CHANCELLOR, M.P., was smaller than the good cause merited. There were present, however, a number of those who have all along closely identified themselves with the co-partnership movement. The programme embodied a really excellent idea for meetings of this kind—the delivery of a number of addresses explanatory of the actual working and success of the system in certain businesses. There were in all nine of these addresses, which were limited to ten minutes each; and two of them referred to the practice of co-partnership in the gas industry—by the Gas Light and Coke Company and the South Metropolitan Gas Company.

The CHAIRMAN, in opening the proceedings, pointed out that the Association had been in existence for nearly forty years. In some industries the principle of co-partnership had been highly successful; while in others this had proved not to be the case. The most striking example of success was to be found in the case of the gas companies. There was, for example, the South Metropolitan Gas Company, by whom a large amount of capital had already been allotted to the workers. They held these shares, and by virtue of their doing so the men were allowed to elect, he believed, one-third of the board of management from among themselves. There they had the whole idea worked out. First, payment of the full rate of wages, then sharing of profits, and, finally, joint management of the business by the election of representatives of the workers. At the present time, there were some forty co-partnership gas companies, with a capital of over 52 millions.

Mr. W. THEOBALD (of the South Metropolitan Gas Company) said he proposed to deal with the scheme in operation with his Company—its purpose, its method, and its success. To make known clearly and unmistakably by all parties concerned what was the object aimed at in his scheme, the great promoter and developer of the co-partnership arrangement thought to be the first necessity for its success; and so he took pains at the start to do what had been done by others as years had gone by—to make it clear both to the shareholders and the employees what purpose the scheme was intended to fulfil. It was two-fold—to increase the prosperity of the Company, and to promote the welfare of the employees. It was, and had always been, considered to be essential to the success of the scheme that, in the first place, it must be of real benefit to the Company, as the employer, and give them some return for the outlay that had been made upon it. It was of equal importance that it must be of real benefit to the workers, and add to their permanent welfare. On this two-fold basis, it was impossible for either party—shareholders or employees—to view the matter selfishly. Each was compelled to recognize that the interest of one was wrapped up in the interest of the other. Co-partnership of this kind was really applying to the human machine the principles which had always been exercised with regard to the mechanical machine. The latter was taken care of and well looked after; and it was said that this was done because it was known that the best work could thereby be obtained from it. Co-partnership applied exactly the same principle to the human machine. It removed ill-will, prevented friction, and did away with some of the sense of inequality of the reward of the worker and antagonism to capital. Co-partnership resulted in better, more cheerful, more interested, and therefore more profitable work. It was the joining of the business and the human elements that had been the life and success of the co-partnership scheme of the Company. By what method had it been sought to carry out this purpose? By such a participation in the profits of the Company as would give a motive to the employee to take an interest in the welfare of the business, and at the same time provide him with an opportunity for improving his position in life. After giving details of the scheme in force, he remarked that, with gas at its present price of 2s. 2d., the bonus was 8½ per cent. The employees were united with the shareholders and the consumers in the enjoyment of the prosperity of the Company. All matters concerning the employees were dealt with by a Committee of Management, consisting of members nominated by the workers and by the Board. This gave opportunity for mutually discussing different points, and had proved of very great advantage. The last step in method was the right given to the employee shareholders to elect three of their number to the Board of Directors—two representing the workmen, and one the officers. It would be seen from what he had said how, by this scheme, the employees had been brought into close touch with everything that concerned the Company and themselves. Was co-partnership a success? This was the most important point. The scheme, improved and developed, had been in existence now for a little over 24 years. It had suffered 5½ years ago the serious loss of the great personality of its founder. Many thought this loss would mean that there would be some slacking off. He was there to state that, instead of slacking off, the co-partnership of the Company had grown stronger and stronger. It was never stronger than it is to-day. Was not this some measure of success? But had it benefited the Company? Well, they all knew what the industrial world had been during the last 24 years—the awful unrest, and great strife and warfare, there had been between Capital and Labour. It was their own experience before; but under co-partnership they had had peace, goodwill, and loyalty. Was not this success? As to whether it had really produced more cheerful and interested work, the engineers—and they were the men to know—had declared again and again that it was so, and had expressed their thankfulness that co-partnership came along and lifted a great burden from

their shoulders. In addition to the financial aspect, the scheme had had a beneficial effect on the characters of the men. He himself had had ample opportunity of noticing this. He was in the service of the Company some six years before the start of the system, and had followed the lives of many of the men; and he could say unhesitatingly that co-partnership, with its new responsibility, incentive to work, and encouragement, had had a very good effect in various ways. It was, of course, of great help in adversity or old age. There was a nice sum of money to augment a pension, or in case of death to help a widow and children. They had also seen what it meant in days of broken health to have available an accumulated sum. A pleasing feature of the scheme was the voluntary addition the workmen themselves made to the sum set aside for them.

Mr. D. MILNE WATSON (the General Manager of the Gas Light and Coke Company) expressed regret that the Governor (Sir Corbet Woodall) could not himself come and give details of the Company's scheme, which, though it was a baby compared with that of the South Metropolitan Company, happened to be a very large and healthy baby. The scheme was started in 1909, when the Directors handed over to the employees (some 8500 in number) the sum of £38,000, by way of a nest-egg. This was distributed among the officers and the ordinary workmen in proportion to their salaries and wages; and it worked out to about £4 10s. per head on an average. Since then the scheme had gone on growing year by year. The price of gas, fortunately for the consumers, had fallen materially; it was now 2s. 6d. per 1000 cubic feet in the Company's district. The bonus was now 5 per cent. on the wages; and this meant that a very considerable sum per annum—something like £44,000—was distributed among the various employees of the Company. Whereas in 1909 there were, as he had stated, 8500 persons sharing in the benefits of co-partnership, there were now no less than 9500 employees coming under the scheme; and they had a sum of £178,000 standing in the books, or an average of something just short of £20 per head. The scheme was practically the same as that of the South Metropolitan Company. One very satisfactory thing was the appreciation by the men of the facilities the scheme offered them for saving. Last year the employees themselves came with £7000 of savings, and asked the Company to invest it in the scheme. This showed a confidence in the Company, and in the scheme, which was most gratifying. A further instance of the desire to make the scheme as beneficial as possible, and to see that the money was not frittered away, was that the employees themselves proposed that there should be a restriction placed on the withdrawals, and that they should be subject to the approval of a Committee of themselves. He did not say that there might not be certain disadvantages in this; but it showed the earnest desire of the men themselves to prevent the money from being spent without proper reason. The Company had found the scheme to work admirably. He did not mean that it was a panacea for all troubles. A case was often spoiled by putting it too high. There was no doubt, however, it did do a great deal of good. The men felt they had a definite interest in the affairs of the Company. They did not like to see another workman wasting time or material. Though sometimes complaints under this heading arrived in the objectionable form of anonymous letters, they nevertheless showed the men's anxiety that there should be no waste, and that they should not be associated with men who were slackers. This, by itself, was a great point in a Company employing from 12,000 to 13,000 workmen. It was an advantage to a man retiring to have, in addition to his pension, a substantial bonus handed over to him; and the assistance afforded to widows was found to be much valued. There was one very hopeful feature, and this was that he believed the Unions were turning round, and beginning to look with less disfavour upon the scheme. It was a matter on which, of course, there was great diversity of opinion; and no doubt some Unions were opposed to the system because they thought it broke away the men from the common body and common interest. But he was of opinion that the movement in favour of the co-partnership principle would grow, and that it would become more generally recognized that there was nothing antagonistic about it—that men could be just as loyal to their class if they were co-partners, and probably would be better unionists because of it. On behalf of the Gas Light and Coke Company, he desired to say they believed in the future of co-partnership, and hoped to see in the near future the principle extended to many other industries up and down the country.

The speakers were heartily thanked for their contributions, on the proposition of Mr. F. MADDISON, seconded by Mr. ANEURIN WILLIAMS, M.P. (the Hon. Secretary of the Association); and a similar compliment was paid to the Chairman for presiding.

CO-PARTNERSHIP SCHEMES IN THE GAS INDUSTRY.

The report of the Labour Co-Partnership Association for the year to Dec. 31 last contains the following tables regarding co-partnership in the gas industry. It is pointed out that two cases of amalgamation during the year reduced the total number of companies, but without altering the totals in the different columns. In each case the number applying to the larger company has been retained as giving the number of years that the scheme has been in operation. Since the date to which the tables were made up, several new schemes have been stated—those, for instance, at Eastbourne, Newmarket, and Redhill. It is remarked that all the schemes seem to be working well. The dividend on wages has risen in nine cases; and in no instance has it decreased.

As to the table of advantages, the following remarks are made: "It must be clearly understood that no claim is made that all the benefits to shareholder and consumer are directly due to the co-partnership scheme. Profits depend on many factors (notably on the fluctuations in the price of coal). We call particular attention to this, because the items in the third and fifth columns of this list are somewhat in the nature of estimates, and because in the case of companies paying maximum dividends the chief benefit the shareholders obtain is increased security, which cannot be stated in £ s. d. One of the larger gas companies writes: 'In the case of this company, increases in dividend and reductions in price of gas have not necessarily any relation to co-partnership bonus; and therefore it is thought that to quote figures would be misleading.' On the other hand, everyone who has had any considerable experience of the working of one of these co-partnership schemes has agreed with the late Sir George Livesey that it has played a considerable part in the prosperity of the undertaking."

Two companies used to be included—Newport (Mon.) and Bridgwater—whose schemes, it is felt, do not really come under the definition of profit-sharing.

Advantages Since the Schemes were Adopted.

Name of Company.	No. of Years.	Total Profits (£) to Employees.	Increased Profits (£) to Shareholders.	Value to Consumers of Reduction in Price of Gas.	
				Per 1000 Cubic Feet.	Total Amount (£).
Chester	12	3,459	Max. Div.	7d.	7,350 per ann.
Leamington	6	2,238	*Nil*	—	*Nil*
Wrexham	6	2,044	Max. Div.	3d.	1,500 per ann.
Tottenham	5½	20,135	12/6 per cent.	5d.	31,165
Tunbridge Wells	5	2,992	922	—	7,450
Walker and Wallsend	5½	1,940	188 per ann.	—	530 per ann.
Wellingborough	5	1,463	—	2d.	—
Croydon	5	10,030	9,900	—	53,376
Dartford	5	843	Max. Div.	—	—
Weston-super-Mare	5	2,697	,,	2d.	—
Grantham	5	698	,,	—	1,762
Cambridge	5	3,293	,,	1d.	—
Cardiff	4½	4,911	,,	2d.	—
Ilford	4½	2,948	740	—	5,137
Waterford	4½	1,026	780	—	2,229
Longwood	4	—	—	3d.	—
Merthyr Tydfil	3	265	2/6 per cent.	1d.	471
Harrow	3	973	*Nil*	—	1,270
Plymouth	3	—	—	—	—
Aldershot	2	—	3/- per cent.	2d.	—
Liverpool	2½	12,780	*Nil*	—	*Nil*
Hertford	2	154	Max. Div.	—	*Nil*

Particulars of Co-partnership and Profit-Sharing in British Gas Companies at Dec. 31, 1913.

Name of Company.	No. of Years Scheme has been in Operation.	Capital in 1913. Total Share and Loan.	No. of Employees under Agreement for Profit-Sharing or Co-partnership.	Amount Divided Among Employees for Year Ending December, 1913.	Amount per Cent. on Wages.	Total Profit to Employees since Scheme was Adopted.	Amount of Shares and Deposits held by Employees in the Company's Market Value on Dec 31, 1913 (about).
		£		£		£	£
S. Metropolitan (*a*)	24	8,325,340	6,225	48,348*	8¼	642,407	441,392§
South Suburban (*b*)	20	1,385,658	814	5,607*	7½	50,090	47,139
Commercial	12½	2,548,280	1,272	7,133*	6	65,946	58,190
Chester	12	181,414	86	512	7½	3,459	2,638
Leamington Priors	6	82,500	103	413	5	2,238	2,371
Wrexham	6	142,160	67	373	7½	2,044	2,012
Bournemouth	5½	752,524	455	3,143	8	11,839	7,566
Rugby	5½	59,327	48	253	6	1,382	787
Tottenham	5½	813,410	628	4,306	7⅞	20,135	19,768
Tunbridge Wells	5½	178,266	145	658	6	2,992	2,603
Walker & Wallsend	5½	271,918	101	440*	4½	1,940	4,890
Wellingborough	5	90,853	64	334*	6	1,463	1,400
Croydon	5	697,252	624	2,961*	6	10,030	16,496
Dartford	5	117,346	45	176	4	843	782
Gas Light and Coke	5	29,542,703	9,561	44,966*	5	182,864	172,019
Gloucester	5	228,303	114	595*	7½	2,504	2,729
Weston-super-Mare	5	126,320	100	314	4	2,697	1,714
Grantham	5	106,068	46	211†	6	698	651
Cambridge	5	199,765	181	921*	6¾	3,293	2,585
Cardiff	4½	703,014	312	1,476*	4⅛	4,911	4,297
Ilford	4½	280,505	172	753	4½	2,948	3,252
Waterford	4½	70,900	52	328	8	1,026	552
Watford	4½	207,772	115	529	5	2,189	2,352
Longwood	4	100,244	39	195	7	440	250
Wandsworth, &c.	4	1,106,937	629	4,435*	7	8,552	6,380
Merthyr Tydfil	3	81,253	33	100	4	266	..
Harrow	3	249,252	105	365	4½	978	..
Plymouth	3	351,500	283	1,088†	5	2,933	2,998
Liverpool	2	1,986,973	1,850	7,818*	5¾	12,780	26,318
Aldershot	2	391,410	141	360	3	694	135
Hertford	2	22,609	22	73	5	154	..
Canterbury	1	158,884	79	265	4½	265	265
Swansea	1	425,011	186	658*	4	658	..
Totals		52,025,671	24,697	140,107		1,047,652	837,531‖

(*a*) Three employee representatives on the Board. (*b*) Two employee representatives on the Board. * Year ending June. † Year ending March, 1913. § Upwards of £30,000 stock belonging to pensioned employees and widows of co-partners has been transferred to the ordinary Share Ledger, and is not included in this figure. ‖ Excluding capital purchased outside the scheme.

Wigan and the Supply of "Free" Gas-Cookers.—At the last meeting of the Wigan Town Council, the question of the advisability of supplying cookers free of rental charges was again mentioned. A member of the Council said he drew the attention of Alderman Angus (the Chairman of the Gas Committee) to the question some months ago. He had searched the minutes to see whether something of a tangible nature was being done; but failing to find anything, he repeated his inquiry. In the course of a reply, Alderman Angus said he received the letter referred to, and had discussed the matter with the Gas Engineer; the latter and himself did not think it advisable to pass any drastic resolution at the present time.

BIRMINGHAM MUNICIPAL UNDERTAKINGS.

The Birmingham City Council held a special meeting last Tuesday —presided over by the LORD MAYOR, Lieutenant-Colonel Martineau— to receive the reports of the trading departments for the year ended March 31. Those relating to the gas and electricity concerns were noticed last week [p. 520].

THE GAS DEPARTMENT.

Alderman Sir HALLEWELL ROGERS, in presenting the report of the Gas Committee, said the surplus profit in relief of the borough rate was £65,584, *plus* the interest on the reserve fund, £3292. This was approximately £12,000 less than was handed over last year. In February, he informed the Council that, in view of the increased cost of coal, oil, and other materials, they must be prepared for a substantial reduction in the contribution to the rates this year; and taking everything into consideration, he thought the Council had reason to be satisfied with the amount handed over. Had it not been for the increase in the output, coupled with the manufacturing costs, which had been greatly reduced, he should have had to face the Council with a much greater reduction in profits. For the year ended March, 1901, when similar conditions existed with regard to coal prices, but when the price of gas was 5d. per 1000 cubic feet higher than at the present time, the surplus profit of the department fell to £554, and it was found necessary to increase the price of gas by 3d. Reference to the accounts would show that the Committee had redeemed various stocks to the extent of over £1,000,000, which was equal to one-third of the whole capital of the undertaking. There was a debit on capital account of £1000 in respect to land and offices; this expenditure being in connection with the high-pressure station which was being erected at Harborne. The extensive additions to plant and machinery which had been required at the various works to meet the increased demand for gas were responsible for the heavy expenditure of upwards of £100,000. The expenditure on mains and meters was due to the increased activities of the department. The increased cost of coal and oil, as shown in the revenue account, amounted to £100,000, having gone up from £463,000 to £565,000 during the year, while in the previous year it went up to the extent of £65,000; so that during the last two years this item alone had increased by £165,000. Rates and taxes had been increased by £4451; and this was really an indirect contribution to the rates, and should be added to the sum handed over to the borough fund. The increase in rates and taxes was due to the increased assessment; and the Council might be interested to know that during the last ten years this item had gone up by about £20,000. It was satisfactory to know there had been an increase in the sale of gas during the year to the extent of £59,000. Residual products had also increased. This was due not to the increased price of the products, but to the increase in the output, which was practically 9 per cent. over the previous year. The result of the trading for the year showed a gross profit of £186,270; and this had been obtained when the average price charged for gas was lower than in any year since the commencement of the undertaking—namely, 1s. 7·41d. per 1000 cubic feet. The price of gas, moreover, in Birmingham was lower than in any other town situated at an equal distance from the gas coal fields. With the interest, the gross profit was increased to £187,922 18s. 1d.; and when the usual charges were deducted, there remained a net balance of £65,000. No less than 718,773 tons of coal were carbonized during the year, and 4,500,000 gallons of gas oil; while the amount of gas sold showed an increase over the previous year of 779 million cubic feet, or something like 9 per cent. During the past four years the consumption of gas had increased by 32 per cent., in the last ten years by 52 per cent., and in the last seventeen years it had practically doubled. Throughout the year the progress of the department had been well maintained.

Mr. MARKS congratulated the Chairman of the Committee that the product which was sold to manufacturers was not sold at a loss, but at a handsome profit. Another point he wished to make by way of commendation was that the department let themselves out for the small consumer. They treated the small consumer well, and the small consumer treated them well, with the result that they did a huge business in their lighting and domestic supply. Then, he wished to congratulate the Committee on the fact that, so far as he could see, there was no window-dressing in the accounts presented. They kept their plant and machinery up to date, and they charged to revenue account those things which should be so charged. This was a wise thing to do. He had only one word to say in adverse criticism, and that was in regard to residuals. This year they seemed to have done very badly with their tar, notwithstanding that, as the Chairman had told them, they had produced very much more. Last year they obtained for their residuals about 75 per cent. of the cost of the raw materials—that was to say, coal and oil. This year they got only 65 per cent. If they had sold their residuals as well as they did last year, they would have made £56,000 more, which would have meant a considerable contribution to the rates.

Mr. DUGGAN said he noticed that the amount realized for tar sold by the Corporation last year was £86,215, and this was an increase on the previous year, which showed an increase on the preceding year; so that it was an increasing sum annually. Would it not be well for a bye-product approximating to £100,000 per annum to be dealt with separately?

Sir HALLEWELL ROGERS, in reply, said, as to the amount realized for tar, if the price had been the same as last year there would have been an increase of about £6000. But the price of tar had gone down, as had the price of the materials upon which the price of the tar was based. With regard to the question of working-up their residual products themselves, experiments were at present being made in the chemical department.

The report was then approved.

ELECTRICITY SUPPLY.

In connection with the electricity undertaking, it was agreed—"That the Finance Committee be instructed to make application to the Local Government Board to sanction a loan of £150,000 for mains, and that, subject to the sanction being obtained, they be authorized to borrow this amount."

Mr. ELLWAY, in moving the adoption of the Electricity Committee's report, said the accounts were the most satisfactory the department had yet presented to the Council. Though the profits were not quite so large as two years ago, they had the satisfaction of knowing they were being earned upon prices for current which were low, and which could compare with those charged in any other town in the country. The capital account had increased by £160,123; and this was due to the developments of the undertaking which, from time to time, had been sanctioned by the Council. The increase in the output was 10½ million units; and of this the Tramway Department were responsible for 3 millions. The gross profit for the year was £167,862, which was £31,000 better than last year. There was a surplus of £45,000, as compared with £27,000; and after carrying £19 500 to the renewals fund, the balance of £25,134 would be paid to the credit of the borough rate. This, the largest contribution they had yet made, was £3500 more than last year.

Mr. MARKS, in urging that a Special Committee of investigation should be appointed, said he thought something should be done to bring the Gas and Electricity Departments together.

Sir HENRY MANTON remarked that nothing was concealed. The Committee were pursuing a career of success; and this was the only answer it was worth while giving to Mr. Marks.

Mr. ELLAWAY pointed out that Mr. Marks had not the support of a single member of the Committee in his criticisms of the undertaking.

THE WATER-WORKS.

Alderman LLOYD presented the report of the Water Committee, and said it was hoped in July to present a full report as to the necessity for augmenting the supply from Wales. Meanwhile, the daily consumption continued to increase. The consumption per head per day had grown from 23 gallons six years ago to over 27 gallons this year. Over 4½ million gallons per day more were being consumed, or an increase of 25 per cent. Compared with the previous year, there was an increase of nearly 4½ per cent.; but the water receipts only showed an increase of a little over 2¼ per cent. Domestic supply, unfortunately, grew very slowly indeed, and was only 1·8 per cent. over the previous year. The principal reason for this was, of course, that so few new houses were being built. The houses supplied during the present year had only increased ⅓ per cent. The measured supplies, resulting from good trade, showed a very satisfactory increase of over 6 per cent. As to the accounts, the gross profits were £221,000 odd, or £3800 more than last year, and, incidentally, more than those of any of the other trading committees. Unfortunately, the charges on capital amounted to £303,000, which was somewhat larger than last year, making the deficiency no less than £80,000. Large as the sum was, it was better by £1500 than the forecast submitted to the Council by the Finance Committee in March. Looking at the question of outstanding capital, he found that the amount to day was £8,002,000, compared with £8,096,000 in 1908.

GAS PROFITS AT NOTTINGHAM.

A Record Year.

If only the staple trade of Nottingham were in as robust a condition as its chief municipal business concern, there would be less grumbling heard in the Metropolis of the lace industry. In relation to the continued substantial success attendant upon the working of the gas undertaking, a spirit of cheerful optimism pervaded the Council at the meeting on Monday of last week, when the adoption of the annual report of the Committee [see "JOURNAL" for May 19, p. 519] was moved by the Chairman (Alderman Albert Ball) chronicling another record year; the profits having amounted to £131,916, of which sum £39,000 was voted in aid of the district rate—a contribution which he was careful to point out it was well able to bear upon a basis of sound finance. At an earlier stage in the proceedings there had been objection forthcoming to the alleged unjust raiding of the profits of municipal trading concerns; but the Chairman urged that the ratepayers had a right to expect a substantial return, having regard to the large amount of money invested in the gas undertaking. Incidentally, it transpired that Nottingham's total municipal indebtedness is now £5,312,892—a reduction of £70,761 having been effected within the last twelve months. The amount of investment in the gas undertaking contributing towards the net obligations was £1,051,391.

Alderman A. BALL explained that 82,651,000 cubic feet more gas had been sold last year than at any other period in the history of the concern. Thanks to greater efficiency in the carbonizing arrangements, largely improved results had been obtained—11,623 cubic feet of gas being sold per ton of coal carbonized, as compared with 11,059 cubic feet in the previous year, an increase of close upon 600 cubic feet. This accounted very largely for their increased profits. The works had been maintained in what might be regarded as a condition of efficiency considering what they were. Most of the works were old ones. There had been spent upon renewals of works, &c., during the year £69,791, in addition to which very large sums had been expended out of revenue upon the Radford works, where new vertical retorts had been installed. A further sum of something like £70,000 would require to be expended before the operations at Radford were completed. At the present moment the Committee had £45,981 in hand towards meeting the cost of these renewals, which, with the £30,000 they proposed by the report to set on one side, would make £75,981 towards completing the work in contemplation at Radford. He hoped the policy of the Committee would be that of continuing to bring all the works up to date. The determination of the Committee was to pay for the whole cost of renewals, as far as possible, out of revenue; so that it would not be necessary to come to the Finance Committee for any large sums. The action of the Finance Committee in taking £39,000 from the profits this year had not damaged the undertaking in any way. It was never in a better position; and if they compared it with many other similarly large gas

oncerns, they would soon recognize that its revenue was not being unduly raided. By the vote proposed by the Finance Committee, he was certain that they would be doing nothing in Nottingham which would prejudice in any way the stability of the undertaking. The Committee had been anxious for a long time to do something for the benefit and relief of consumers. They had been carefully considering whether it would be to the best interest of their consumers to abolish meter-rents or make a reduction in the price of gas. All the members of the Committee were desirous of helping the smallest consumers, and they thought the best way possible would be to make a rebate to prepayment customers, and give a further halfpenny in the shilling. This would render the reduction to small consumers equivalent to 1¾d. per 1000 cubic feet. With the reduction of 1d. made some two or three years ago, this would make a reduction of something like 5d. per 1000 cubic feet, which would place the smallest consumer upon a fair basis, as before they were paying too much in comparison with ordinary consumers. The 1d. per 1000 cubic feet to ordinary consumers would be a considerably greater concession than the mere abolition of meter-rents. At the same time he could assure the Council that every member of the Committee fully felt, when they were next in a position to make a reduction, they would probably consider the abolition of the meter-rents. The future of the gas undertaking, judging from prevailing conditions, was not, however, over-bright. The markets for residuals were never in a worse state. Tar, carbolic, and almost every residual which they manufactured, with the single exception of creosote, had fallen very fast in price. Still they hoped to be able to make the reductions indicated in the report, which would amount to something like £11,000, without in any way seriously affecting their position. They still hoped to be able next year to make a further substantial contribution in relief of the rates. Having regard to the huge sum invested in the gas undertaking, it was only right and fair that the most substantial contribution should be made in relief of local burdens. In view of what had been said by certain gentlemen as to raiding the profits of municipal undertakings, he thought it only right that he should point out that, in relation to the gas revenue, they were doing nothing like what had been carried out before. In 1902, when the reserve fund was nothing like it was to-day, and when the general condition of the works was anything but satisfactory, the whole of the profit of £24,516 was taken in relief of rates. What were the Committee doing to-day? They were putting £30,000 by towards remodelling the works; and in this respect they were surely not doing anything which any sound business man would not do in regard to his own affairs. He was satisfied that, as long as the Committee conducted the undertaking upon the lines which were now being followed, it would prosper. He could not allow this opportunity to pass without paying a high compliment to their Engineer, Mr. John Wilkinson. He was an excellent man, and took a keen interest in his work. Having complimented Mr. Garton, the Accountant, and the staff generally, the speaker said, in conclusion, he thought they had cause for congratulation in the possesion of such an efficiently managed concern.

Alderman F. R. RADFORD seconded the adoption of the report.

Mr. E. RICHARDS remarked that the Committee were deferring the operation of the reductions to consumers until Jan. 1 next, which was almost at the end of the financial year. Why not begin it right away? He did not think it would interfere with any present which they would be able to make to the Finance Committee. He quite agreed that they could well afford to give £39,000 in relief of the rates; but he thought they might at the same time have extended their generosity to the consumers, and begin the reductions by at any rate June 1. He did not quite understand the Chairman's statement as to slot-meter consumers being now put upon a proper basis, because when they obtained their rebate of 1½d. in the shilling they would still be paying 2s. 11d. per 1000 cubic feet; whereas ordinary consumers were only paying 2s. 3d. He granted that they should pay a little extra; but he did not think they should be called upon to pay 8d. more than the ordinary consumers. He should also like the Chairman to give them some indication that the present policy of working the retort-houses in seven shifts a week would be altered. He welcomed the announcement that they might look shortly for the abolition of meter-rents. There was one other question he should like to bring under the notice of the Chairman—that having reference to the cost of gas for public street lighting. The public lighting department was a large customer, having during the last year paid for 78 million cubic feet of gas. There might be some objection to reducing the price charged to the Lighting Committee; but he thought the time had come when the Gas Committee might be asked to make a grant to them. They were paying 2s. 2d. for gas which cost only 1s. 5d. to produce. It would relieve the situation greatly if the Gas Committee would now make a grant of £2000 or £3000 a year to the Lighting Committee.

Alderman BYRON asked whether it was not possible for the Gas Committee to extend more generous treatment to the farmers in the district regarding the price charged for sulphate of ammonia. They complained that they could get a large supply delivered to them at the same price as they obtained it from the works.

Mr. BOWLES said that, despite the gloomy forebodings which had been indulged in, in consequence of the falling off in prices of residuals, it was satisfactory to know that the year's results constituted a record in the history of the undertaking. It was also gratifying to learn that the claims of the smaller consumers had at last been taken into consideration. Personally, however, he did not think the Gas Committee could claim very much credit for what they were doing. It seemed to him the reduction of 1d. in one case and ½d. in another was nothing very great when they remembered that the increased profits of the Committee during recent years had been something like £25,000. In this, a record year, why should not the anomalous charge for meter-rents be wiped out altogether? To charge 8d. for the rent of a meter, and to use the same meter (as he had known of in one case) for 36 years, seemed to be ridiculously unfair. He trusted that next year the meter-rents would be wiped out entirely. He should like to know at what price the coal now in stock had been taken for the purpose of valuation.

Alderman Sir JOHN TURNEY thought the Committee merited congratulation on the nature of the report, and hoped they would continue to work the undertaking upon the same sound business lines as in the past. If their friends were patient, they would most probably get what they wanted. As to Mr. Richards' suggestion, he thought that the Works and Ways Committee, of which he (Sir John) was Chairman, might with just as much reason ask the Gas Committee to reduce the price of gas as supplied to them as to reduce the price to the Lighting Committee. If they did it, however, it was only equivalent to taking the money out of one pocket and putting it in another. If they were going to make a grant of £3000, as suggested by Mr. Richards, to the Lighting Committee, it would merely mean that the Gas Committee would have so much less to dispose of.

Alderman BALL, replying on the discussion, pointed out, in regard to Mr. Richards' observations, that slot-meter consumers had meters and gas cookers free of charge. Very often it happened that, after having had a cooker for three or four weeks, they messed it up, and when it was returned to the works an expenditure of 8s. or 9s. was incurred in repairing and cleaning it. It must also be remembered that there was considerable extra cost involved in collecting the money from prepayment meters. He thought that when the small consumers received the further reduction of ½d. recommended by the Gas Committee they would have been treated absolutely fairly, and be placed upon about the same basis as ordinary consumers. As to the seven shifts a week worked by the men to whom Mr. Richards had referred, the reason no alteration was made was because the men themselves would not want to give up the arrangement, although the Committee themselves would prefer to see the shifts altered. As to the preferential treatment which it had been urged should be given to the Lighting Committee, they could not discuss it. Why should they? With regard to Mr. Byron's inquiry about better consideration for the farmers, the Gas Committee would be delighted if they would use more sulphate of ammonia. The market price had gone down very much; the rate being now only £10 10s., compared with £15 last year. They would be very glad if local farmers wanted sulphate to give them the very best terms possible. It was said that others whom they supplied were selling it at a lower price; but he could not understand this. As to Mr. Bowles's observation, he wanted to have the meter-rents abolished in order that some supposed more substantial advantage might be conceded; but the Committee had done more, having given double that which it would have cost to abolish meter-rents. Mr. Bowles had asked for £6000; but the Committee had given them £11,000. If they had simply abolished meter-rents, they would not have done all that they thought they could afford to do. They were desirous of going one better, and so had made the reductions proposed. The Committee would, he was certain, give the question of the meter-rents consideration when they felt in a position to deal with the matter. Mr. Bowles wanted to know the price at which the coal in stock was valued. He could assure him that the valuation had been made upon a very fair basis.

The report recommending the grant of £39,000 in relief of the district rate was then adopted,

ST. HELENS GAS-WORKS.

Effect of Vertical Retorts.

It has been reported at a meeting of the St. Helens Gas Committee that the surplus profit for the past year amounted to nearly £6000; and it was decided to hand £3500 of this over to the relief of the rates. The profit for the previous year was £8700; but there are, of course, various causes to amply explain the smaller amount on the present occasion—the increased cost of coal, the reduction in the charges for gas, and the decreased prices obtainable for residuals. The cost of the capital standing against the works is less to-day than when the undertaking was originally bought by the Corporation, notwithstanding the great growth of the concern and the first-rate modern equipment, not only at the works, but throughout the area of supply. It is estimated that the difference in the price of gas is upwards of £3000, and in the price of coal and residuals between £3000 and £4000.

Referring to the vertical retorts, a local paper says: "There is not the slightest doubt that the ratepayers of St. Helens have much to be thankful for in the wisdom of the Committee in introducing the Glover-West retorts at the works. This revolution in gas manufacture has been found to realize all expectations. The Committee have recently decided on a new scheme, which, when completed, will be of even greater benefit to the ratepayers. The gas-works are being conducted in a most efficient, yet economical, manner in every department; and the Committee have provided for the ever-growing demand for gas. The increase in the demand for gas is very striking, in view of the continued extension of the electricity works. Gas is now laid on to practically every cottage in the town for lighting and cooking, and in many houses for heating purposes also. With the extension to Haydock, and to the two new districts within the gas area at Sutton, the Committee's responsibilities are increasing. But the new scheme just referred to shows that they are alive to their responsibilities, and to the requirements of the community, not only at the present time, but also in the future. A remarkable feature about the St. Helens gas undertaking is that, though the output of gas has increased so largely, it has not yet been necessary to build new works. The adoption of the Glover-West retort has made it possible to use the Warrington Road site solely, thus putting off to a time in the still-distant future the necessity for spending £100,000 on a new works and equipment."

Belfast Electricity Department.—A Sub-Committee of the Belfast Corporation Electricity Committee who have been considering allegations by Councillor F. Curley in regard to the management of the department have held over twenty meetings for the taking of evidence. One of the allegations was that in certain cases current was being supplied under cost price. It is believed that the services of experts will be called in to assist the Sub-Committee in arriving at a conclusion; and it is also thought that two reports—a majority report and a minority one—will be presented to the parent Committee.

HEYWOOD CORPORATION GAS DEPARTMENT.

Report and Accounts.

The Gas Engineer and Manager of the Heywood Corporation (Mr. Walter Whatmough) has presented to the Gas Committee his report for the year ended the 31st of March. It contains the following particulars.

The gross revenue amounted to £24,236, and the gross expenditure to £17,472; leaving a gross profit of £6764, or £780 more than for the year 1912-13. There was paid a sum of £6231 for interest and the contribution to the sinking fund; and the net profit was £533. The receipts for gas sold for all purposes amounted to £18,711, compared with £17,847, or an increase of £864. Prepayment meters and private consumers account for this satisfactory result; the former showing an increase of £548 and the latter one of £211. For the first time a new item appears under this account, amounting to £59, for high-pressure outside shop lighting. The receipts for residuals show a large decrease; but, owing to improved working results with the new plant, the loss is only £411, compared with £888 on the previous year's basis. The expenditure on the manufacture of gas was £11,989, compared with £12,579, or a reduction of £590. Coal cost £649 more, due to the further advance of 1s. 6d. per ton; but carbonizing shows a decrease of £869; and maintenance charges are £354 lower.

With regard to working, Mr. Whatmough reports that during the year 12,113 tons of coal and 54 tons of cannel were carbonized, or a total of 12,167 tons, against 12,671 tons for 1912-13—a decrease of 504 tons. The gas made per ton of coal carbonized was 12,196 cubic feet, against 11,029 cubic feet—an increase of 1167 cubic feet. The quantity of benzol used was 50·4 gallons, against 5225 gallons, or 221 gallons less than before. The total quantity of gas manufactured amounted to 148,398,000 cubic feet, or an increase of 8,647,000 cubic feet; and the total quantity sold, as registered by the consumers' meters, was 136,915,780 cubic feet, or an increase of 5,549,245 cubic feet. The unaccounted-for gas was 8,942,877 cubic feet, or 6·02 per cent.

Mr. Whatmough gives a statement furnishing particulars of the gas consumption for the year; and he points out that recorded for offices and works is very much more than before, because the new carbonizing plant and high-pressure installation are worked by gas-engines—the quantity used for this purpose being 855,100 cubic feet. The gas consumed in dwellings and shops by ordinary meters shows an increase of 1,761,353 cubic feet, against a decrease of 726,772 cubic feet for the previous year. For public lighting there is a slight increase of 91,222 cubic feet; for mills and workshops, a decrease of 359,770 cubic feet. Prepayment meters and stoves and motive power show an increase of 3,160,650 cubic feet and 548,000 cubic feet respectively.

The new installation of vertical retorts [described in the "JOURNAL" for April 22, 1913] has been in operation for twelve months, and considering the increase of 1s. 6d. per ton for coal, the decrease of £411 in receipts for residuals, the increase of £146 for rates and taxes, and the higher charge of £711 for interest and sinking fund, Mr. Whatmough has no doubt the Committee will consider the increased profit of £68 satisfactory. Had the prices of coal and residuals remained the same as in 1912-13, the profit would have been £2599 instead of £534, or an increase of £2066.

In the early part of last year, a conference was held with the members of the Heywood Tradesmen's Association, with reference to outside high-pressure shop lighting, and the Committee decided to carry out an installation on condition that a minimum of twenty 100-candle power lamps was guaranteed for three years. This was agreed to, and the installation was brought into use on Oct. 31. The light has been appreciated by the shopkeepers and the public generally. There are 39 lamps in use; and Mr. Whatmough suggests that the system should be extended.

MONTE VIDEO GAS COMPANY.

Satisfactory Expansion in Sales of Gas.

The Forty-Second Ordinary General Meeting of the Company was held last Wednesday, at Winchester House, Old Broad Street, E.C.—Mr. CHARLES HUNT (the Chairman) presiding.

The SECRETARY (Mr. Henry Kearns) having read the notice convening the meeting and the report of the Auditors, the Directors' report and the statement of accounts for the year ended Dec. 31 were taken as read.

The CHAIRMAN said he desired, in the first place, to express for his colleagues, as well as for himself their great sorrow for the death of the late Chairman, Mr. T. C. Tatham, and their deep sense of the heavy loss the Company had thereby sustained. His services as a Director covered the very long period of over thirty years, stretching back to the time when the Company were still enjoying the privileges of their original concession. The non-renewal of this concession when it expired a few years later was a serious blow to the Company, involving, as it did, not only the loss of the public lighting, from which considerable revenue had been derived, but also liability for payment of customs duties, from which they had previously been exempted under the terms of the concession. It, moreover, opened the door to competition for which the Company were ill-prepared by a heavy overburden of capital, accompanied by an exceedingly high price for gas, which materially checked consumption. It was true that favouring circumstances secured to the Company a further period of comparative prosperity; but the inevitable result occurred when the electric light became, in the hands of the Government, the formidable rival it had since continued to be. Mr. Tatham was always strongly impressed with the necessity for meeting this change of circumstances by lowering the price of gas, and at the same time broadening the basis of the Company's business; and the present improved position in both these respects was largely due to his initiative. When he added that the bulk of the gas was now being sold at only one-half the price that was charged at the commencement of Mr. Tatham's chairmanship, and that during the same period the consumption had been more than doubled, it would be realized that he was paying to Mr. Tatham's memory no empty tribute. He felt sure the shareholders would wish that they should place on record at this meeting their very high appreciation of the late Chairman's long and excellent services, and also of the unfailing tact and courtesy with which he had for the last fourteen years carried out the duties of the chair. To fill the vacancy, the Board were glad to have had the choice of a successor of such wide administrative and business experience as Mr. William E. Horne. As to the working during the past year, he might first call attention to the increase of 9·75 per cent. in the sales of gas—which was the more gratifying inasmuch as Monte Video had been, and still was, passing through a period of commercial depression, which had greatly increased the number of empty houses. It was very satisfactory, moreover, that, according to the latest advices, this rate of increase in gas sales continued to be more than fully maintained. The whole of the increase—in fact, more than the whole—was for purposes other than lighting. For lighting purposes, the Company continued, though to a diminishing extent, to lose ground, notwithstanding all that was being done to retain this consumption by giving free maintenance of burners and other advantages to consumers, and in spite also of the fact that, light for light, gas was the cheapest illuminant. It was, however, a source of considerable satisfaction that the use of gas for cooking and heating had at length fairly "caught on," so to speak, and was to all appearances becoming increasingly popular. He wished it could be said that the profits had increased correspondingly to the consumption of gas; but unfortunately this was far from being the case. The revenue account showed that the total expenses of the gas-works, dock, &c., increased by about £9000 in round figures, as compared with those of the previous year. Much of this was, as a matter of course, attributable to more coal being used and more labour employed to produce a larger quantity of gas; but the price of coal, including freight, was also higher by 1s. 6d. per ton than in the previous year. Wages were, moreover, substantially advanced; and extra expenditure had to be incurred in overhauling and repairing mains and service-pipes, consequent upon extensive repairs and repaving of the roads and streets by the Municipality, and in the sales department for gratuitous services to consumers. In this department, also, a good deal of fitting work was being done at less remunerative prices than formerly, with the object of securing permanent customers for gas, rather than the obtaining of an immediate profit on the work done. And this policy was having its effect in the increase of gas consumption. On the other hand, the receipts showed an improvement of only about £2000, notwithstanding the substantial increase in gas sales. This was mainly attributable to the falling off in receipts for coke and coal, for which an outbreak of competition among the principal coal importers (completely upsetting fuel prices) was largely responsible. How long such a very undesirable state of things would continue, it was impossible to say. So far, there were no signs of any improvement. The diminished profit which these figures indicated would make it necessary, in order to continue the same rate of dividend as was paid last year—namely, 4 per cent.—to take the sum of £346 from the balance of profit brought forward from the previous year. It would, as a matter of course, have been much more pleasing had it been possible to add to the fund instead of having to take from it. But it had to be remembered that, after all, one of its objects was the equalization of dividends; and with continued expansion of business brighter days should follow. There were a few other features of the accounts to which it might be expected that he should refer. Taking first of all the debit side of the balance-sheet, the reserve for renewals remained unaltered; but this would now be drawn upon for carrying out the work which was mentioned last year. The contingency fund was reduced by £1872, representing the depreciation of investments during the year. Since the commencement of 1914 there had been a slight improvement in values, though quite insufficient to compensate for what had had necessarily to be written off. On the same side of the account, among the liabilities was a loan from their bankers of £1500. This had since been increased, pending a more favourable opportunity for the realizing of securities. The first item to attract attention on the other side of the balance-sheet was an increase in the amount of capital expenditure during the past year. This represented nearly eight miles of additional mains laid, besides a considerable number of meters fixed. Capital expenditure, if kept within bounds, might be regarded as a healthy sign, because it indicated (or should indicate) the continued progress of the undertaking. As already remarked, the Company were very greatly overweighted with capital at the commencement of their career; and the reduction of this as compared with the business done had been an imperative necessity. Continued increase of output without proportionate expenditure had already brought about a great improvement, which could not but be augmented should the business continue to expand at anything like the present rate. He was expressing the opinion of all expert gas administrators when he said it was only the low-capitalized gas undertakings that could hope to prosper in the face of present-day competition. The stock of gas-fittings, cookers, and accessories figured at over £3000 more than in the previous year. This was attributable to an increase in the number of cookers and heating appliances put out on hire. The stock of materials for use or sale, &c., showed an increase of over £6000; while shipments afloat were more by £2888. The dock department continued to be fully employed throughout the year, and at fairly remunerative prices, having regard to the competition to which this branch of the Company's business was subject. A cable had been received a few weeks ago stating that an unprecedentedly severe storm had swept along the coast, flooding the gas-works, and doing other damage. The supply of gas was not interrupted; and it was hoped the loss would not be serious. As regarded the business generally, the Board saw no reason why there should not be a continuance for some time to come of something like the present rate of increase of gas consumption; and with the object of concerting measures for further development of the business, they had had the advantage of another visit last autumn from Mr. Lane, their General Manager at Monte Video. Mr. Lane's previous visit home was in 1911; and in the interval Mr. Kearns, the Secretary, went out to Monte Video to confer with Mr. Lane. In this way, the Board had been kept satisfactorily in touch both with the business and also with the

principal officials there, who were by the same means kept informed of gas progress at home to a much greater extent than they could possibly be by any amount of correspondence. In conclusion, he moved the adoption of the report and accounts.

Mr. JOHN MEWS seconded the motion.

Mr. T. DENCE thought the Company was in an extremely sound condition; and he hoped the present rate of dividend might be continued. The existing price of the shares did not wholly reflect the position of the Company; but they need not trouble themselves on this score.

Mr. C. C. MALLET expressed on the part of the shareholders their deep regret at the loss sustained by the death of the late Chairman. He went on to remark that, with a life-long experience of South America. It was the duty of the Board to send out one of their members at frequent intervals.

Mr. R. DEMPSTER asked how the Company came to be the owner of a dock and an engineering works, and said he did not see that it was necessary for Directors and officials to be always going backwards and forwards. How were the Company getting on with the extension scheme?

The CHAIRMAN replied that the dock was constructed very many years ago, with the idea that it would assist in getting coals to the gas-works; and the repairing business had grown up since then, as an auxiliary. He himself visited Monte Video in 1906, and went thoroughly into matters. Whenever it seemed to the Board advisable, another member would go out. In the meantime, they believed their interests were being sufficiently looked after by having the Manager over here and conferring with him on all questions of business. They were now negotiating the contract for the extensions.

The resolution was then carried unanimously.

On the proposition of the CHAIRMAN, a dividend was declared of 10s. per share, less income-tax, making with the interim payment a dividend of 4 per cent. for the year.

The retiring Directors and Auditors were appointed.

The CHAIRMAN proposed a vote of thanks to the whole of the staff of the Company for their services during the past year. In Mr. Lane, he said, they had a thoroughly competent officer, who was most popular in Monte Video, and whose relations with the Government had enabled the Company to tide-over various difficulties. He was ably seconded by the whole of the officers the other side; while over here they were all much indebted to Mr. Kearns.

The resolution was agreed to, as also was one of sympathy with the family of the late Mr. Tatham; and the meeting was brought to a close with a vote of thanks to the Chairman and Directors, which was proposed by Mr. MALLET and seconded by Mr. F. W. CHURCH.

CAPE TOWN AND DISTRICT GASLIGHT COMPANY.

An Improved Position—Colonial Coal.

The Twenty-Fourth Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, Egypt House, New Broad Street, E.C.—Mr. J. E. LILLEY, J.P., in the chair. Unlike some of the recent meetings of the Company, the whole of the business was concluded within half-an-hour.

The SECRETARY (Mr. R. W. Blackburn) having read the notice convening the meeting, the report and accounts were taken as read.

The CHAIRMAN said that, if the shareholders referred to the report, they would see at the foot a statement relating to the annual make of gas. This showed that the quantity of gas manufactured in the twelve months to Dec. 31 last (the period under review) was larger than in the previous year. There had, indeed, been a very considerable recovery from the year 1909. Then the make was down to 136 million cubic feet; whereas for 1913 it went up to 146 millions. They were, he hoped, on the way to still bigger figures. The chief object of interest, and of anxiety, during the past year had been the subject of coal. It might be remembered that at the meeting twelve months ago he informed the proprietors that English coal was dearer in price than they had been accustomed to. At the same time, freights had also gone up; a contract on unusually favourable terms having expired. He had told them, too, of tests which had been, and were being, carried out with Colonial coal. With regard to the test of one particular kind of coal, the Board were then hopeful, but not assured. Later, however, they became assured as to its suitability for gas making purposes; and they immediately adopted it, as far as they were able to do so. But they had hardly done anything, before the supplies were stopped by a strike; and then following upon this was the general strike movement. The Company were therefore thrown back upon English coal; and it was very expensive. During this period, they were helped very much by the water-gas plant, of which they made good use. The upshot was that they managed to get through the crisis all right, though at considerably increased cost for coal. As a matter of fact, coal cost them for the year 4s. 6½d. per ton more than in the previous twelve months. Towards the end of the year, the Company were again able to secure supplies of Colonial coal; and from that time to the present they had gone on using it. It was of fair quality—not so good as the English coal they had been in the habit of using; but it cost them somewhat less. Taking its lower cost, and setting the results beside those from English coal, he thought he might say it would compare with English coal at the normal price of a couple of years ago—about 30s. per ton. They were quite in hopes that they might succeed in getting better results still when the new retorts were erected. They considered it wise to keep a store of English coal on the works, in case of irregularity in the supply or quality of the Colonial coal. He was sorry to say that, as mentioned in the report, the contract for the new retorts had not yet been absolutely completed. They relied upon these retorts for the bringing about of considerable economies. Everything practicable had been done to urge the work forward. The contractors had stated that the delay was due to labour troubles; and they promised that the retorts would be ready by the end of June. The number of gas consumers at the end of 1913, as compared with the close of the previous year, showed a decrease of 84. But notwithstanding this the sales had been somewhat better. The Company were gradually securing business in connection with trading undertakings—that was to say, gas was being more used for industrial and manufacturing purposes. They did not get so good a price for the gas so sold as for that disposed of to ordinary domestic consumers. But it had to be borne in mind that the expenses of supply were also less; so that the business was really very good. With regard to appliances employed in the consumption of gas, the numbers of these in use continued to increase. One very successful branch was the supply of geysers, which were very much used in the district of Cape Town. The Company manufactured all these geysers themselves, as they could do so more cheaply than they could export them from this side; and they were made to a pattern which permitted of their being easily repaired. With gas-fires and radiators they found themselves unable to make any progress, as they were so little required. Turning to the accounts, they would notice that the cost of manufacture and distribution of gas was £27,151, as against £24,270. This increase had been caused chiefly by the extra cost of coal, though some of the rise was accounted for by the additional quantity of gas manufactured. On the credit side, gas sales and meter-rental amounted to £50,768, compared with £50,157. Residuals had yielded about £800 less. The result was that there was a balance of gross profit for the year, carried to the profit and loss account, of £17,001, against £15,089 in the previous year. After payment of debenture interest and the writing-off of £423 for depreciation of stock, and £6000 on account of the new retort installation (which was a very good contribution out of one year's earnings for these retorts, and left £6180 to be dealt with in the future in the same manner), there was left a balance of £3918 of profit in the balance-sheet. In regard to the capital account, they would find that the 6 per cent. debenture capital stood at £33,000, as against £38,000 a year ago—£5000 having been redeemed during the twelve months. As to the disposal of the balance on profit and loss account, the Directors recommended that a sum of £2250 should be devoted to the payment of a half-year's dividend on the preference shares. Unfortunately, they had been unable to pay one for many years past. Efforts were being made to come to an arrangement by which they might redeem the 6 per cent. debentures on much better terms than at present. After the payment of the preference dividend referred to, there would be an amount of £1668, which it was proposed to carry forward. The dividend would be paid as soon as possible; but the proprietors must not expect to get it at once. He concluded by moving the adoption of the report and accounts.

Mr. H. R. SAVORY seconded the motion, which was unanimously passed without any questions being asked by the shareholders.

On the proposition of the CHAIRMAN, seconded by Mr. SAVORY, the retiring Director (Mr. R. A. Fairclough) was then re-elected; and the Auditors (Messrs. Kemp, Sons, Sendell, and Co.) were re-appointed on the motion of Mr. J. L. CHAPMAN.

Mr. CHAPMAN, in proposing a hearty vote of thanks to the Chairman and Directors, said it seemed to him that they had done wonderfully well. He thought the manner in which they were pulling the Company round was worthy of the commendation of the shareholders. The interest which the Chairman in particular took in the business was really marvellous.

Mr. E. NICHOLLS, who seconded, remarked that the Board had had particularly difficult matters to deal with. It appeared that the Company were on the eve of very much better times.

The CHAIRMAN, after the vote had been cordially passed, said the great cause of the improved position of affairs had been the removal of the gas manufacturing operations from two works to one. This had a cost a lot of money; but they were now reaping the benefit of the outlay. Revenue had had to bear the cost of this; but the Company were benefiting. The improvement had been due to the cheapening of the cost of gas manufacture. He felt, too, that it was only right he should bear testimony to the loyalty of the officers, by whom the Company were excellently served.

THE NEW GAS STANDARD.

[From the "Daily Telegraph."]

Writing in yesterday's issue, the Engineering Correspondent of the "Daily Telegraph" made the following remarks regarding "Heat Value *versus* Illuminating Power."

The recent decision of a House of Lords Committee, presided over by Lord Clinton, upon the methods to be adopted in future for ascertaining the quality of coal gas, marks an era in the history of the gas industry. Hitherto, and ever since gas-testing methods were prescribed by Parliament (for the protection of the public), the standard by which the quality of gas was judged was simply the amount of light given by a flame. So long as the only method of obtaining light from gas was by burning it as a luminous flame—*e.g.*, in a "fish tail" burner—and its use as a fuel for cooking, heating, and power had not been fully developed, this test for "illuminating power" was both scientific and equitable.

Since the famous discovery of the incandescent mantle by Welsbach, following upon the equally famous invention of the atmospheric or non-luminous burner by Bunsen, made the only economical and sensible method of obtaining light from gas depend upon the heating power of the flame (which, though burnt so as to give no light itself, raises the mantle to a glowing heat), and since the use of gas for fuel in both home and factory has become almost universal, the only practical standard whereby gas can be judged is its heating power—that is, its calorific value," as expressed in British thermal units per cubic foot of gas burnt. That is what the House of Lords Committee, on the evidence of Sir Corbet Woodall, D.Sc., and other eminent experts, have now agreed shall be the standard of the future, so far as the largest Company in the world is concerned; and this decision will no doubt speedily be applied to the undertakings of the country as a whole. The result will be, almost certainly, to effect material economies in the cost of gas manufacture, from which, under the wise provisions of the sliding-scale

system (whereby increased dividends are made to depend upon decreased prices to the consumer) the public will benefit to the extent of about five-sixths of any savings made.

The new standard of calorific value ranges between 475 and 540 B.Th.U. per cubic foot of gas. This means, with gas at 2s. 6d. per 1000 feet, that we shall obtain 16,700 B.Th.U. for every penny spent on gas. It has been suggested that an average value of 500 B.Th.U. is on the high side, and that ultimately we shall see the figure reduced to 300, when the selling price could be lowered to 1s. per 1000 cubic feet. On this basis the consumer would obtain no less than 25,000 B.Th.U. for 1d.—a great increase on the present 16,700 B.Th.U. figure.

With almost every commodity of household and industrial consumption tending to rise in price—and not least the other forms of fuel—it is good news for the public that Parliament has determined to abolish an out-of-date method of gas testing, and to substitute one that, while meeting all practical requirements of to-day, relaxes in no way the stringent stipulations as to purity which have been laid down in former days, and yet secures economy in production, with resultant gain to the purchaser.

The adoption of the new standard may not be welcomed by those very few—less than 4 per cent.—of gas consumers who still adhere to the old-fashioned flat-flame burners; but the remedy is so simple and obvious, and the advantages of incandescent lighting so manifold, that it will surely not be long before the users of the older type of illumination make the inevitable change. They will most assuredly reap a speedy return for their enterprise. Another class who will benefit by the new standard of illumination are the users of engines running on benzol, seeing that much more of this spirit will now be able to be "stripped" from the coal gas than was formerly the case.

Altogether we welcome very heartily this most important development in the world of gas.

IMPROVED STREET LIGHTING AT NOTTINGHAM.

In fulfilment of their determination to remove the reproach which has too long rested upon the city, of being one of the worst lighted in the Midlands, the Nottingham authorities are contemplating further large and necessary expenditure. The standard type of burner, the adoption of which the Chairman of the Gas Committee has more than once urged as being necessary in place of the varied assortment at present in use, has not yet been decided upon, but much is being done by the installation of certain well-known patterns of which experience has demonstrated the value. In Carrington Street, a complete metamorphosis has been effected by the introduction of high-pressure lamps, and in many of the other leading thoroughfares—notably Mansfield Road—striking improvements in lighting arrangements have been carried out.

That the change is appreciated is shown by the fact that, though a spirit of rigid economy permeated the last meeting of the Council, when the annual budget was under consideration, involving an inevitable addition to the district rate, there was no demur to the greatly increased requirements of the Lighting Committee, who were voted £1475 more than last year; the figures being £17,680, compared with £16,205 for the twelve months ended March 31 last. In presenting the estimates, the Chairman of the Finance Committee admitted that Nottingham had not been so well lighted in the past as many people wished it had been, and there could be no objection to the Committee's demand, as the money would be well spent in effecting the improvements needed. But Mr. Richards was not satisfied that the Finance Committee had gone far enough in the matter. The Lighting Committee, after careful consideration of all the details, had asked for £18,180 to meet the expenses of the ensuing year. But the Finance Committee reduced the estimate by £1000. The Lighting Committee, however, in the interest of the ratepayers and the good of the city, felt that their original figures should be adhered to. The Finance Committee then made the amount of the reduction £500; but in order to enable the Lighting Committee to do its work efficiently, he asked that the sum originally estimated for should be restored. The Committee had largely reduced the suggested expenditure on automatic lighting arrangements which the Committee wished to see carried out generally in the city, and they had reduced the estimated cost of £400 for repainting the lamp-columns to £50. He appealed for the reinstatement of the figures as first presented; but the Chairman of the Finance Committee declined to acquiesce in the suggestion, thinking that those responsible for the lighting arrangements had already been treated generously. Probably, however, history will repeat itself in Nottingham. There have been many previous occasions upon which, in spite of the Finance Committee's obduracy, other committees have spent as much as or more than the original estimates, and possibly no serious objection will be raised to a repetition of this course if some of the archaic lamps at present in use in the city, serving only to make darkness visible, are scrapped in favour of up-to-date appliances.

Typical of the desire which is now being generally manifested locally as to improved arrangements, notice of a resolution had been given by Mr. Gibson that it should be an instruction to the Lighting Committee to confer with the Electrical Engineer, with the view to the arranging for experiments being carried out in certain streets by suspending metal filament electric lamps from cables across such streets or attached to the tramway standards. But the volume of other business prevented this proposal being debated, and Mr. Gibson's resolution stands over for consideration until an adjourned meeting of the Council on June 8.

Bolton Lamplighters' Leisure.—The Bolton Town Council have again discussed the demands of the local lamplighters. The men had asked for a week-end rest every eight weeks, instead of one in thirteen; but the Corporation refused. The Corporation, however, now state that if the men can arrange it among themselves, without cost to the Corporation and without efficient light being affected, the men can take a week-end off every eight weeks. The men have accepted the conditions.

STREET LIGHTING SPECIFICATION.

Mr. Jacques Abady's Reply to Electricians' Criticisms.

In a letter which appeared in the "Electrician" on Friday, Mr. Jacques Abady replied to the electricians' criticisms of his suggested clauses in street lighting specifications [*ante*, p. 420], some extracts from which were given in the "JOURNAL" last week.

With regard to Mr. Kenelm Edgcumbe, Mr. Abady says he appears to have "misread the article or to have misunderstood it."

As to Mr. Wild, he says: "Mr. Wild does not agree with my statement as to comparative illumination in the example I cited. I am sorry, but I have no manner of doubt that one of these days Mr. Wild's doubts as to the accuracy of my view will vanish. As to clause 9, sub-clause 4, this was drafted deliberately to exclude empiricism and consequent inaccuracy. I am glad Mr. Wild agrees that the clause as drafted will only permit of an accurate instrument being used. When an accurate empirical photometer appears, the clause can be modified. As to the angles, here I think Mr. Wild is wrong. In any case, this is detail, and I am sure that the more the particular suggestion I made as to angles is investigated, the greater will be the approval."

Mr. Abady does not think there is anything in Mr. Harrison's communication which deals with new ground or raises fresh points which have not already been discussed. He then adds: "Generally as to the requirement I suggested, that the light at 20° should be at least 15 per cent. more than that at 50°, it appears to be overlooked that this suggestion is based upon actual experiment and practical experience. It should be remembered that the 'sphere of influence' of the 20° angle is one in which one is obtaining the illumination from two sources of light, while at the 50° angle one is relying practically on the unaided light from one source. I know that the result of carrying out the suggestion is the provision of nicely-graded lighting free from 'glare.'"

In conclusion, Mr. Abady expresses his pleasure at noting the generosity with which his specification has been received, both by the Editor of the "Electrician" and by his correspondents; and he can only hope that it may be found to contain some suggestions at least which will have general utility.

VIOLENT TORNADO IN CALCUTTA.

Extensive Damage to the Public Lamps.

On the night of the 28th ult., Calcutta was visited by the most violent hailstorm within living memory. Indications of something approaching were given between six and seven o'clock in the evening, when an occasional roll of thunder was heard in the north-west. At eight o'clock, however, the hailstorm came on with considerable fury, and lasted for about fifteen minutes. The hailstones were of extraordinary size, and were carried with such force that no windows which were squarely struck could withstand the battering. According to the Calcutta "Statesman," the city presented the appearance of a place which had been struck by a Western blizzard. At about nine o'clock, the whole of the Chowringhee and the Maidan looked like one vast sheet of ice floating on the top of a sea of water. When the cyclone had passed, the city was more or less a scene of miserable and hopeless destruction and desolation. Windows were broken wholesale—thousands of panes of glass being smashed by the force of the hail. Nearly every lamp—and there are about 13,000 of them—in the roads was damaged or smashed completely; and many streets were without any lights whatever, as the lamps were absolutely ruined. As, according to the last contract, the public lighting plant is the property of the Corporation, the loss will fall upon them, and not upon the Oriental Gas Company, who only supply the gas. To add to the horrors of the noise caused by the storm, the supply of electric current became affected in a great part of the city; houses being plunged into darkness with dramatic suddenness and the ventilating fans being stopped. The storm played havoc with the electric light wires, some of which crashed down upon the backs of two men and a boy, killing them instantaneously. Horses also were electrocuted. The staff of the Tramways Company were at work as soon as practicable in attempting to repair the wires; but the darkness of the night and the general destruction handicapped them severely. The electric lights and fans did not recover their full power; and all most people got was a mere flicker in the bulb and the slowest of revolutions in the fan. Fortunately, however, the night was a cool one; the temperature having fallen 20° in about five minutes. The maximum wind velocity recorded during its passage was 60 miles per hour; and the rainfall amounted to an inch.

MANCHESTER CORPORATION WATER DEPARTMENT.

Annual Report—The Longdendale Valley Works.

The Annual Report of the Manchester Water Committee shows that the consumption of water during the past financial year was, on the average, 44,103,908 gallons per day. Of this quantity 26,283,245 gallons were derived from Longdendale, and 17,820,663 gallons from Thirlmere. The growth in the demand for water is still maintained; and the commercial developments taking place within the area of supply indicate that the progressive rate of increase in the future will tend to exceed that experienced in the past. The work connected with the third line of pipes to the city is approaching completion. The laying and jointing of the 44-inch and 40-inch pipes at the various syphons is finished; and the works are being tested. The syphons are situated in the valleys on the line of aqueduct, and the aggregate length of pipes laid is about 54 miles.

A controversy centres round the question as to whether or not the Longdendale reservoirs are safe in times of heavy rain floods; and the

question of strengthening the embankments was again before the Water Committee at a recent meeting. The Sub-Committee who have had the matter in hand reported that there was no danger; but this view was not generally accepted by the Committee. Upon a proposal being submitted that no further action should be taken, the voting was equal—the Chairman of the Committee (Alderman Edward Holt, J.P.) declining to vote either way; and further consideration of the matter was adjourned for a month. According to the "Manchester City News," one member of the Committee, in discussing the question, said a misunderstanding had arisen as to the alleged danger at Longdendale. There was no danger of the water bursting its banks; but it was true that in case of flood there was a possible danger that the water would fill up, rush over the embankment, and gradually wear the tops away. As a result, it had to be kept 5 feet below the ordinary storm level; and Manchester thus lost storage capacity of no less than 400 million gallons—a most serious item for the city. Another member ridiculed the idea that Longdendale was in a dangerous state. It had stood the test of years; and the Sub-Committee, after inspection, had come to the conclusion that very little expenditure was needed.

Mr. Joseph Swarbrick, M.Inst.C.E., a member of the Council, who has an extensive civil engineering practice in the North of England, has tabled a notice of motion which will probably come up at the June meeting, by which time it is expected the Committee will have their report ready. The motion is as follows: "That the Town Clerk be requested to ask the Local Government Board to appoint one of their Engineering Inspectors, as soon as the arrangements of the Board will permit, in order that he may in the first place make an inspection of the water-works in the Longdendale Valley, and subsequently take the evidence of Messrs. G. H. Hill and Sons, the Water-Works Engineers to the Corporation, to the effect that it is urgent for the Corporation to proceed with the execution of certain works sanctioned by Parliament in 1908, to ensure the safety of the whole of the work themselves, as well as to prevent danger to the lives and property of the population in the valley below the works; such Inspector, if he thinks fit, to be at liberty to hear the evidence of those members of the Water-Works Committee who are still averse to the work being proceeded with, or of any other persons whom such members may desire to invite to give evidence. That the Local Government Board be invited, at the conclusion of the inquiry, to advise the Corporation as to what action should be taken with regard to the proposed works recommended by the Engineers."

Site of the Leigh Gas-Works.—The Leigh (near Southend) Ratepayers' Association have passed a resolution requesting that before the Southend Corporation spent further capital at the Leigh Gas-Works, they should carefully consider the desirability of removing the works from their present position or selling them, with their removal as a condition of sale. Objection was expressed by several speakers to the works remaining on the shore; but opinion was by no means unanimous as to where it would be best for them to be placed.

NOTTINGHAM AND DERWENT WATER SCHEME.

[From a Local Correspondent.]

Though the other contributing authorities, Leicester and Derby, were also vitally concerned, Nottingham may be said to have been affected in a peculiar degree by the attempt made last week by the Sheffield Corporation to secure practically the abrogation of clauses in the agreement under which the four authorities undertook, in a specified ratio of contribution, to finance the Derwent Valley water scheme.

Of all the parties concerned in the venture, which has given rise to much legal quibbling, Nottingham finds itself in the position of the least advantage; later discoveries of copious new supplies contiguous to the municipal boundaries having rendered the city practically independent of the Derbyshire resources, in tapping which £3,465,919 had been spent up to the end of the last financial year. The City would have fared badly had Sheffield's contention been accepted. The expenditure (involving payments up to September last of no less than £541,281 in interest upon borrowed capital) has already been sufficiently formidable; but there is much more to follow, and, with local burdens growing apace in other directions, Nottingham would welcome its entire release from the undertaking, its participation in which it is now clearly demonstrated might have been avoided had there been a little more perspicacity forthcoming regarding possible resources close to the city's own doors. The irony of the situation has been increased lately by the temporary abandoment of the Derbyshire supply, consequent upon the baneful effect it was found to be producing upon the hot-water appliances for domestic supply. Leicester and Derby cannot, as matters stand, do without the Derwent water; but Nottingham would welcome its release from the Joint Board compact. With conflicting interests constantly arising, the representatives of the four municipalities have never formed a very harmonious family. Those whose work lies mainly at Westminster appear, however, to have done very well out of the venture; the Parliamentary expenses up to the end of 1912 having amounted to no less than £107,504.

Heywood and Middleton Water Board.—The annual report of the Board, which was presented at last week's meeting, stated that the receipts for water showed an increase of £238 for domestic and £615 for trade purposes. The net increased income from water was £818, and the total net increased income £840. As the expenditure had increased by £92 only, there was a reduced deficiency of £748 compared with last year. After meeting all revenue charges, there remains a deficiency of £9977, as compared with £10,725. Of this amount £5051 was apportioned to the Corporation of Heywood for payment, and £4926 to the Corporation of Middleton. The report was accepted; and the Board ordered that the precepts for the sums mentioned be served on Heywood and Middleton.

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NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The question as to whether a gas manager should attend the meeting of the Institution of Gas Engineers officially, and at the expense of the corporation or company he serves, has again arisen in a discussion which took place at the Falkirk Town Council recently regarding the proposal that their Electrical Engineer should attend the annual congress of the Municipal Electrical Association at Birmingham, and that Mr. W. Wilson, the Gas Manager, should attend the annual meeting of the Institution of Gas Engineers at Liverpool. This question has been discussed in many council chambers, and, happily, and no doubt rightly, the result has been the same as at Falkirk—that approval has been given for the necessary expenditure, so that the manager may attend. There is no doubt that the information obtained by a gas manager at such meetings is for the general good of the undertaking he represents, far more than any personal benefit it may be to the man himself. The Technical Press can give the actual words used by the readers of the papers and the discussion taking place thereon; but it cannot report what does not come under its immediate notice. It is the personal discussions, which take place in and about the meeting hall, where experiences are exchanged and advice asked for and obtained, which give the greatest value to those attending. Apart from the question of attending the meetings, the gas manager is likely to become somewhat of a hermit. There is only one of his clan in his district; and without the information carried from works to works by gentlemen of the commercial side, the gas manager would frequently be without much information of the doings in other places. On this account, also, it is advisable that he should attend the technical association meetings. Who is to bear the expense of the journey, &c.? If the benefit is for the undertaking, then the undertaking should pay; and each undertaking must then decide the extent to which its funds can go in this respect. It is not to be supposed that a small concern supplying only a few million cubic feet annually can afford to send its manager to one and all the meetings of the many gas associations; and the Directors must then choose and decide at which of these they are to be represented. Thousands of pounds have been saved through these meetings, and no doubt will be again; so that the corporations and companies should not deal with this question in a niggardly manner.

Mr. L. Hislop's report on the Port-Glasgow Gas-Works is sweeping in its condemnation of the present works, and anyone who knows the place will not be surprised at the suggestion to go to an entirely new site. The remarks regarding the gasholder and governor are distinctly disquieting. The Town Council have evidently accepted Mr. Hislop's report in all its details, and are now busy considering an offer of the Caledonian Railway Company for a new site at Fyfe Park. This proposal is a drastic one; and it is to be hoped that the Council have not decided to entirely scrap the old works without a full consideration of the expense into which they will be led, which it is said will amount to about £30,000. This, at 5 per cent. for interest and sinking fund, means £1500 per annum to be added to the amount at present being paid. The leakage is also very serious, as, according to the latest Board of Trade returns, it amounts to nearly 1½ million cubic feet per mile of main, or about 20 per cent. of the gas made. This for a town not situated in a mining district is certainly much in excess of that usually found, and is probably unequalled in Great Britain. The subject of unaccounted-for gas is a most important one. It is of little use obtaining a large quantity of gas from each ton of coal if one-fifth of what is made is lost in the distribution. It is certainly the first duty of any manager of a gas-works to reduce this unaccounted-for gas to as low a figure as possible. Where there are excessive distances between the services, there more leakage must be expected; and where the quantity of gas sold per mile of main is small, there is also some reason for the excess. There are two ways of reducing unaccounted-for gas—one is to remove the cause or leaky or porous pipes, and the other to increase the consumption. A case has come recently to notice where, owing to an increased sale, the percentage of gas unaccounted-for had dropped. On a careful analysis of the figures, however, it was found that in reality the amount lost had increased over the previous year. This goes to show how the common method of referring to the leakage as a percentage of the make is not a sound one. Whether the other plan—of referring to it in cubic feet lost per mile of main—really meets the case is also questionable, as without knowing the number of consumers and the gas sold also per mile of main, the statement is not entirely conclusive. Possibly a combined figure, found by some form of equation which would take all the factors into consideration, would meet the case; but this would have to take into account also the age and length of the services, as some people consider these are the greatest cause of the unaccounted-for gas. Probably the station meter is the principal offender, as it is not unusual to find that this instrument is not tested so frequently as it should be, and possibly the water line is not kept as exact as it should be. The temptation to show a large make of gas per ton is no doubt a great one; but the subject of the loss of gas in the mains speaks quite as much for the capability of the manager, and should have more credit given to it than is usually the case.

Several times recently there have been cases of trouble in the mining districts through the formation of gases in the mines; and these have been noticed in the Press as explosions of "coal gas." In as far as the gases have been given off by the coal, they are no doubt coal gases; but the name "coal gas" has been so long associated with the product of the complete distillation of coal in retorts, that it is likely to be thought by mere casual readers that such explosions have been caused by the gas which is the subject of the attentions of most of those who read these lines. The contradiction of these paragraphs, so far as they concern our industry, might be another feature of the work of the British Commercial Gas Association.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 25.

The market generally continues dull, and there are few developments to report. Pitch is slightly easier, and the price cannot be called above 37s. per ton in bulk at makers' works. For pyridine, 8s. 6d. per gallon net, into buyers' packages, has been made; and the price is now 8s. 6d. to 8s. 7½d. Other values are: Creosote, 3⅜d. per gallon net in bulk; benzol, 1s. 2d. per gallon; 90 per cent. toluol, 11d. per gallon; 90-160 solvent naphtha, 10⅜d. per gallon, all net and naked; 60's crude carbolic acid, 1s. 2d. per gallon net, casks free.

Sulphate of ammonia has again declined in value, and the present price for prompt is £11 per ton net, and naked at makers' works, for 25 per cent. quality.

Manchester Tar Prices.

It is officially announced that the average price realized for April deliveries of tar in the Manchester district—based on the value of the products—was 31s. 4d. per ton.

Tar and Tar Products in the Provinces.

May 25.

The average values during the week were: Tar, 25s. 3d. to 29s. 3d. Pitch, east coast, 34s. 6d. to 35s.; west coast, Manchester, 33s. 9d. to 34s. 3d.; Liverpool, 35s. to 35s. 6d.; Clyde, 35s. to 35s. 3d. Benzol, 90 per cent., naked, North, 10d. to 10½d.; 50-90 per cent., naked, North, 10d. to 10½d. Toluol, naked, North, 10½d. to 11d. Crude naphtha, in bulk, North, 4⅜d. to 5d. Solvent naphtha, naked, North, 9½d. to 9½d. f.o.b. Heavy naphtha, naked, North, 9d. to 9½d. f.o.b. Creosote, in bulk, North, 3⅛d. to 3⅜d. Heavy oils, in bulk, 3⅝d. to 4⅛d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 0½d. to 1s. 1d. Naphthalene, £4 10s. to £10; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1⅝d. to 1⅞d.; "B" quality, nominally, ¾d. per unit, packages included and delivered.

Sulphate of Ammonia Prices in the Provinces.

LIVERPOOL, *May* 23.

Although the decline has not been so rapid this week as it was in the first half of the month, the market has continued to have a drooping tendency, and still lower prices have been accepted at all points. The volume of new business has been small, and there have been ample supplies for the purpose of covering old contracts. The nearest values to-day are £11 1s. 3d. per ton f.o.b. Hull, £11 2s. 6d. per ton f.o.b. Liverpool, and £11 5s. per ton f.o.b. Leith. Manufacturers have modified their views with regard to future delivery, and it is reported that several contracts have been made over the second half of this year on the basis of £11 5s. per ton f.o.b. good port.

Nitrate of Soda.

The market for this article is quiet but fairly steady at 9s. 10½d. per cwt. for ordinary quality, and 10s. 1½d. for refined, on spot.

From another source it is reported that a further drop has been experienced in sulphate of ammonia during the past week, and, judging by the prices which are being offered for the forward position, a still lower market is likely to be seen. Outside London, makes are quoted at £10 5s. to £10 6s. 3d.; Hull, £11 2s. 6d.; Liverpool, £11 5s.; Leith, £11 5s. to £11 7s. 6d.; Middlesbrough, £11 2s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The demand for coal is strengthened by the approach of the holidays, especially for steam qualities; and the tone is thus very firm for the next three weeks or so. Best Northumbrian steams are 14s. 3d. to 14s. 9d. per ton f.o.b.; second-class steams are 12s. to 12s. 4½d. per ton; and steam smalls are easier at about 7s. 3d. to 8s. 6d. per ton f.o.b. The output is good, and is readily taken up; but steamers are less plentiful than they were, so that the advance in price of steam coals is less apparent than has been the case at this season of the year. In gas coal, the local consumption is moderate; but there are fair exports, with inquiries for forward sales. Best Durham gas coals are steady at 13s. 6d. to 13s. 7½d. per ton f.o.b.; second-class coals are 12s. 8d. per ton; and "Wear specials" 14s. A number of small contracts for gas coal are in the market; also those for the Newcastle and Gateshead Gas Company, which are for some 300,000 tons, for twelve months. These are expected to be decided in the course of a few days. The tendency of prices is steady for early delivery; but for long contracts, quotations lower than those now ruling are anticipated, though some coalowners who are well contracted ahead do not make concessions so readily. In coke there is a fair demand. Gas coke is stiffened by the full exports at a time when the production is low. Good gas coke is from 13s. 3d. to 13s. 9d. per ton f.o.b. in the Tyne.

GAS COAL CONTRACTS.

[By a Correspondent of the "Financial Times," May 19.]

Contracts for gas coals are mostly arranged for periods of twelve months from July 1, and usually by this time a considerable tonnage has been fixed up. Prices of present contracts are 3s. 6d. per ton higher than for 1911-12. After the six weeks' national strike of miners early in 1912, collieries readily obtained advances of 2s. and 2s. 6d. per ton for contract renewals; and last year they secured such further advances as brought prices up 3s. 6d. per ton on the two years. These

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advances were to cover the increased costs of production, following the various legislative measures that were passed, and also the several advances in wages to the colliers. It is understood that most collieries will insist on the same prices for contract renewals. Gas concerns, however, are expecting substantial reductions; and, while there are a good few inquiries in the market, little business has been arranged at present. From a colliery owner's point of view (and considering the serious inroads the extended use of gas for cooking and heating have made on the retail house coal trade), there is no reason why gas coal values should be below parity with house coal prices. It really looks as though colliery owners are entirely masters of the situation, especially as gas concerns are practically bound to arrange for a large proportion of their requirements on contract, in order to secure themselves. The chief argument put forward by gas managers for price reductions is that the values of residuals have fallen very considerably during the past twelve months.

Huddersfield Gas Profits.—The Borough Treasurer submitted, at last Wednesday's meeting of the Huddersfield Council, a statement of the income and expenditure on revenue account of the gas undertaking for the year ended March 31 last, which showed a surplus balance of £672. This it was resolved should be transferred to the credit of the depreciation and contingencies account. Mr. Mitchell (the Chairman of the Gas Committee) pointed out that the difference between the financial statements for the past year and for the preceding twelve months was practically all accounted for by the extra amount paid for coal. About £1200 had been involved in increase of wages and holidays. Altogether there had been an increase in the expenditure of £10,735, and in the income of only £2680. The Committee greatly regretted that in this way the profit had been reduced almost to vanishing point.

Evesham Gas Undertaking.—At the quarterly meeting of the Evesham Town Council last Wednesday, Alderman Fisher, the Chairman of the Gas Committee, reported that the quantity of gas sold for all purposes during the past financial year was 52,624,000 cubic feet—an increase of 5,696,000 cubic feet. The gross profit realized was £2280. From this had been deducted £672 for depreciation, interest and instalment of loan £70, and contribution to the rates £550. This left a balance of £988 to carry to the profit and loss account. A sum of £738 had been expended on new plant, mains, and services, and £165 on new meters. They had in stock coal and materials to the value of £441, amounts were due from creditors of £2361, and there was a credit balance at the bank of £1747—a total of £4550. On the other side, their only liabilities were £667, the amount of loan outstanding, and £1142 due to sundry creditors. The last two items represented all their liabilities. The cost of materials during the year had been high; but he hoped it had reached high water mark. Coal alone cost £225 more than in the previous year, while the residuals market had weakened. The increased business done had, however, enabled them to more than hold their own, and also showed that the reduction in the price of gas during 1912 had been appreciated.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards conducted a sale of gas and water stocks and shares which included an important new issue of capital by the Wandsworth, Wimbledon, and Epsom District Gas Company. It consisted of £20,000 of new ordinary stock and £10,000 of 4 per cent. debenture stock; the former ranking for a standard dividend of 3¾ per cent., subject to the sliding-scale, equally with the existing similar stock and the Wandsworth "C" stock (both of which are now receiving dividend at the rate of £5 17s. 3d. per cent. per annum), and the latter being a perpetual and irredeemable debenture stock. The ordinary stock was all placed at £110 10s. to £116 per £100; and the debenture stock at £90 to £90 15s. per £100. By order of executors, some shares and stock in the Hayward's Heath District Gas Company, the Dorking Gas Company, and the Dorking Water Company were offered for sale. A few £10 fully-paid additional 7 cent. shares in the first-named Company, carrying dividend at the rate of £9 12s. 6d. per cent. per annum, fetched £18 each. Some £25 "A" shares in the Dorking Gas Company (10 per cent. maximum dividend, and last at the rate of 5 per cent.), were sold at £24 apiece; 5 per cent. £25 "D" shares at £23 each; and some 5 per cent. perpetual debenture stock at £108 per £100, *cum div.* as from the 1st ult. Some £10 fully-paid 6 per cent. "A" preference shares in the Dorking Water Company fetched £13 apiece; a few £10 "B" preference shares (5 per cent.), £11 15s. each; fully-paid ordinary £10 shares, ranking for a maximum dividend of 10 per cent., but carrying 7 per cent., £16 15s. each; and £10 fully-paid 7 per cent. "B" shares, carrying £4 18s. per cent., £11 10s. to £11 15s. apiece.—At a sale by auction conducted by Mr. H. J. Hetherington at Eton, last Wednesday, ten £20 "O" shares in the Windsor Gas Company were sold for £44 apiece, and eleven £8 "P" shares for £11 each.

Gas Consumption at Smethwick.—A report issued by the Smethwick Gas Committee states that the quantity of gas sold during the year ended March 31 last was 548,757,900 cubic feet—an increase of 5,691,400 cubic feet, or 1·05 per cent., over the previous year.

Portsmouth Water Company.—At the half-yearly meeting of this Company last Thursday, the Directors reported that the revenue in the six months ended March 31 was £39,603, and the expenditure £16,761, which left £22,842 to be carried to the profit and loss account. The total of the account was £24,638, out of which the full statutory dividends were recommended. The sum to be carried forward was £4261. The length of street service mains was 174½ miles, and of the trunk mains 67¾ miles. The number of new supplies at the close of the half year was 299; making 53,345 premises under constant service. The quantity of water supplied in the six months was 1,489,745,095 gallons—an increase of 349,507 gallons as compared with the corresponding period of last year. The extension to Portchester had been completed, and a number of consumers connected. The report was adopted.

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Coventry Gas Undertaking.

The past year's working of the Coventry Corporation gas undertaking resulted in net profits amounting to £12,638. The revenue from all sources amounted to £171,245, compared with £166,456 the previous year. The working expenses were £136,695, against £124,629; leaving a gross profit of £34,550, compared with £41,827 before. The increase in the working expenses is almost entirely accounted for by the higher cost of coal. The Gas Committee are recommending to the City Council that the surplus profits should be dealt with as follows: That £5000 should be paid into the general district fund in aid of the rates; that £7000 should be set aside towards meeting the loss of capital consequent upon the abandonment of plant at the old works, making with the amounts previously allocated £65,000 towards meeting an estimated loss of £67,000; and that the balance of £638 should be carried forward. The Council will also be asked to agree to a reduction in the price of gas to consumers using prepayment meters from 2s. 10d. to 2s. 8d. per 1000 cubic feet. The accounts for 1912-13 showed net profits amounting to £20,298, out of which £5000 was paid to the general district fund, £5000 was transferred to the reserve fund, and £10,000 was written off capital.

Minimum Wage Question in Birmingham.

A meeting of the Joint Committee on Labour, which is composed of representatives of all the labour-employing committees of the Birmingham City Council, has been held to consider a proposal which had been referred to them by the General Purposes Committee that the minimum rate of wages paid to the Corporation workmen should be raised to 30s. a week. Two years ago the minimum wage was increased to 26s. a week for all unskilled labour; and at the Council meeting in February last Mr. Hallas proposed the following resolution: "That it be an instruction to the several committees of the Council to pay all male servants or workmen in their employ who have attained the age of 21 a wage of not less than 30s. a week." A long discussion ensued, and two or three amendments were moved—one, which Mr. Hallas was willing to accept, being that a minimum wage of 28s. should be paid to those Corporation workmen who were 25 years of age or over. But eventually the subject was referred to the General Purposes Committee to deal with in a similar manner to that of the navvies' wages. The business before the Joint Committee was conducted in private, and apart from the reception of deputations very little was done; the discussion of the subject being adjourned. It was, however, pointed out that about 7000 workmen were directly concerned in the proposal, and that if the minimum wage were raised to 30s. a week, the other and more highly-paid workmen, equally large in number, would expect an increase; so that the proposal, if adopted, would probably involve a further expenditure by the Corporation in wages of £60,000 to £70,000 a year.

Gas v. Electricity Income at Nottingham.

Compared with the striking results attained last year in connection with the Nottingham Corporation Gas-Works, the profits derived in this period from the electricity supply are of moderate proportions for general illuminating purposes. The net result of the year's trading is to leave £8000 in relief of the district rate, in contrast with £39,000 similarly devoted from gas profits. Of the balance of £41,216 which is available from the total income, £11,900 has gone in interest, and £13,837 as an instalment in repayment of loans. The sum of £4471 has been transferred to the reserve fund, which cannot be regarded as excessive in view of the expenditure which the concern may be called upon to meet at no distant date, having regard to the archaic character of the plant at the oldest of the generating stations. Utilization of motive power by the installation of turbines on the Trent has been long since vetoed on scientific grounds, by reason of the uncertain volume of the river at suggested points; but it is inevitable that if the electric supply is to be maintained at a larger ratio of profit than is at present available, those responsible for the control of arrangements must adopt a policy more in unison with the modern methods of the Committee which has charge of gas production.

Price of Gas at Bolton.

Reference was made in the "JOURNAL" for April 21 [p. 202] to the decision of the Bolton Gas Committee to reduce the price of gas by 2d. per 1000 cubic feet for domestic supply, and 4d. for power purposes—this reduction having been conceded after considerable local agitation both in and out of the Council chamber during the past few months. At the last meeting of the Council, however, Mr. Ainsworth succeeded in getting the matter referred back, in order that it could be further thrashed out in committee. He said he noticed that the resolution to reduce the price by 4d. referred specifically to cotton mills and bleachworks, provided that a minimum of 50,000 cubic feet was consumed per annum. Mr. Crook suggested that the Gas Committee should have a maximum price and a sliding-scale. They did not want consumers who only had gas as a stand-by; it did not pay them for the mains or the meters. As to the poor consumer, was it any use taking 2d. off the gas and putting it on the rates, for the landlord would take good care to get it back by putting 3d. on the rent? Mr. Ritson said if they did not reduce the price to power consumers as well as to small consumers—especially power users—they were going to have no profits at all for the rates. They went on promising to make a reduction; and if they continued putting the matter off, they would lose their large power consumers. Alderman Webster (Chairman of the Gas Committee) said he came to the meeting strongly opposed to taking the matter back; but he would now agree. Perhaps sufficient information had not been given to the Council. He wanted to tell the Council, however, that they must reduce the price of gas.

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Smoke Abatement Committee.

The recently appointed Committee on Smoke Abatement held their first meeting on Thursday last at the offices of the Local Government Board—Mr. Russell Rea, M.P., in the chair. Professor J. W. Graham, Principal of Dalton Hall, University of Manchester, and President of the Smoke Abatement League, gave evidence, in the course of which he said that nearly half of the smoke found in the centre of Manchester came from domestic fires, while the domestic consumption of coal was only one-fifth of the total. The Chairman interposed the remark that the domestic grate was by far the worst offender. Professor Graham said that in Glasgow they had come to the conclusion that one factory chimney as a smoke producer was equal to 39 domestic chimneys. If they could get rid of half the smoke, it would make an enormous difference to the towns. Gas at 1s. 6d. or 1s. 9d. per 1000 cubic feet was as cheap as coal for domestic use, and had the other advantages of cleanliness and saving of labour. It would be well if municipalities sold gas at even less than cost price, because the loss would be more than balanced by the advantages in the cleanliness of the city. The atmosphere of Manchester had improved during the past twenty years through the diminution of smoke production and the increasing use of gas. They had fewer fogs than formerly. Although there were no figures to go upon, he thought the improvement was continuous. The Committee adjourned until the 10th prox.

Price of Gas at Colwyn Bay.—The completion of another successful year's working leads the Colwyn Bay Urban District Council to contemplate a reduction of 5d. in the price of gas—namely, from 3s. 4d. to 2s. 11d. per 1000 cubic feet.

Mossley Corporation Gas Undertaking.—The annual report of the Mossley Corporation Gas Department shows that there has been a net loss on last year's working of £1016. There was a gross profit of £5916; but this was more than absorbed by instalments to sinking fund, which amount to £3449, and interest amounting to £3483.

A New Meter-Works at Leith.—The "Edinburgh Evening Dispatch" notices the advent of a new meter manufacturing concern at Leith, in these words: Speculation has been rife for some time back as to whose hands the large mansion house and grounds of Seacote, Leith, had passed into. It now transpires that the purchasers are Mr. Thomas Fox, the Meter Manager for Messrs. James Milne and Son, Limited, Abbeyhill, and Councillor D. F. Kirk, of Burntisland, a representative for the same firm, together with J. Goskin Wood and his son, both well known to the printing trade. The mansion house is being converted into a works for the purpose of manufacturing all classes of gas-meters and gas appliances; and the firm will be carried on under the name of the Four-Coin Meter Company. The grounds are large in extent, and allow great scope for extension. The buildings have been in the hands of tradesmen for a week or two, and are almost completed for commencing operations.

New Public Lighting Contract for Preston.

The Streets and Buildings Committee of the Preston Corporation have had before them tenders from the National Electric Supply Company and the Preston Gas Company for the supply, erection, and maintenance of ninety 1000-candle power lamps for lighting the central area of the town. The Electric Supply Company offered on a seven years' contract from Oct. 1 next, the following terms: (*a*) Lamps burning 3500 hours per annum at £7 10s. per annum; (*b*) lamps burning 2000 hours per annum at £6 per lamp per annum. The Gas Company offered: 1000-candle lamps for 3500 hours per annum at £9 10s. per lamp per annum, and 1000-candle lamps for 2000 hours per annum at £7 10s. per lamp per annum. The Company, in their letter, pointed out that they were prepared to increase the discount on the price for the whole of the gas consumed for the public lighting of the borough from 20 to 25 per cent., and to contribute to the Corporation the sum of £500 per annum for three years towards the cost of converting flat-flame to incandescent burner lamps, on condition that the Corporation undertook, for a period of not less than seven years, to continue the use of gas for public lighting to the same extent as at present in all the streets and roads within the borough that are now lit by gas, and that they would agree to the limitation of their powers under section 45 of the Preston Gas Act, foregoing their right to be supplied with gas for illuminating purposes at the lower rate at which the Company might desire to supply gas for power purposes. The proposed concession to the Corporation of a further 5 per cent. discount is equal to £400 per annum on the basis of the consumption of gas for the public lighting for the twelve months ended February last. The Committee recommend the acceptance of the Company's tender on the terms and conditions stated.

Brigg Water Supply.—Negotiations have been on foot for the acquisition by the Brigg Urban District Council of the water-works of the Lord of the Manor. But as he asks £10,000 for them, the Council consider the price unreasonable. They are, however, prepared to consider a greatly reduced offer.

South African Lighting Association, Limited.—The report of the Directors of this Company to be presented to the shareholders at the twenty-fifth ordinary general meeting to be held to-morrow (Wednesday) states that last year the consumption of gas showed an increase at both Port Elizabeth and Grahamstown. At the former place the price was reduced, and considerable expenditure was incurred on alterations and improvements at the works. A reduction in price at Grahamstown was made on Jan. 1. The use of a larger proportion of Colonial coal, together with improved working results, have effected a considerable saving in working expenses. The Directors regard the year's work as satisfactory; and, after placing £1000 to the reserve, they recommend a dividend at the rate of 9 per cent. for the year, less income-tax. Of this dividend, 3½ per cent. was paid last October. The final dividend of 5½ per cent. will amount to £4950, and leave a sum of £2356 to be carried forward.

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Prospects at South Barracas (Buenos Ayres).

In moving, at the annual general meeting of the South Barracas (Buenos Ayres) Gas and Coke Company, Limited, the adoption of the report [which was referred to on p. 526 of last week's "JOURNAL"], the Chairman (Mr. J. C. im Thurn) read the following extracts from the report of the Manager (Mr. R. B. Brown) on the prospects of the Company: "The length of mains of the Company amount to nearly 116 miles; while the number of consumers is but 3000, giving only 26 customers per mile of main. This is owing to our districts—with the exception of Avellaneda—being largely composed of residential villas, with large gardens. In the other cases, the mains have been laid in districts with an eye for the future, as in a large number of instances two or three squares of mains have been laid to give a supply to four or five customers at the end of these extensions; while the other portion, at present with no customers, will come into use as the estates are built-up, and will give a return to the Company with the increase of population, which tends to grow very rapidly. So it will be seen by this that our Company's small number of consumers per mile of main is owing to the exceptional circumstances of the districts we supply, and is a capital expenditure which will remedy itself as the districts are built up; and it is a distinct advantage to have the mains laid ready for the new buildings, so that we are prepared at once with a supply. We have laid our mains before the roads are paved, thereby saving a considerable sum. The districts we are supplying are filling up, and the municipalities are alive to the importance of making good roads. The City of Buenos Ayres has long ago grown outside the Federal limits; and the enormous development of the southern suburbs is the best proof. Every new home established, every new enterprise undertaken, means increased business for us; and the Railway Company have introduced a first-class local service, which gives every facility to the rapidly increasing population. From these facts you will see that the districts served by the Company have been developing, with a corresponding increase of business for ourselves, which must be a very encouraging sign for the future welfare of the Company."

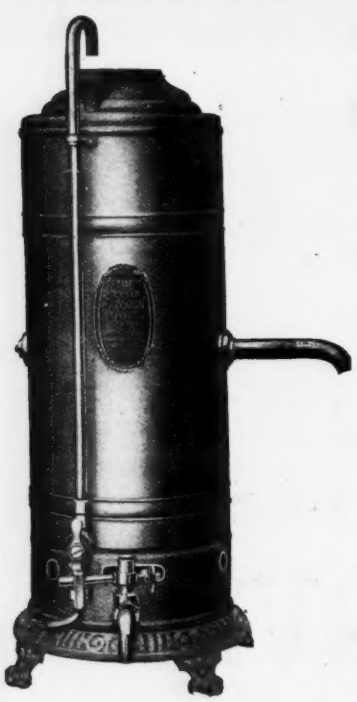
Hindley Gas and Water Results.—It is stated that the profits of the Hindley (near Wigan) Gas Department for the year ended March 31 were £419, and of the Water Department £72.

Oldham Gas Undertaking.—At the meeting of the Gas Committee of the Oldham Corporation last Wednesday, the General Manager (Mr. A. Andrew) reported that the result of last year's working showed that, after the payment to the borough fund of £7500, there was a deficiency of £19,581, which would reduce the balance standing to the credit of the profit and loss account from £26,843 to £7262. Nearly the whole of the difference was caused by the increasing cost of coal and the diminished receipts from residuals. The Chairman of the Committee (the Mayor, Mr. H. Wilde) said that they had paid £15,000 more for coal and £2000 more for labour, while coke had brought in £5500 less and residuals £3090 less. The reserve stands at £48,000.

Meters Limited.—Moving the adoption of the report and accounts [*ante*, p. 529] at the annual meeting in Manchester last Friday, Alderman John Miles, J.P., said the Company held its own, and secured its full share of the business to be done. The management of their works could not be improved upon for the purpose of showing a reasonable return on their capital; and this was why they had been able to make more profit. Having now brought the reserve up to a round £100,000, he trusted that they might in future be able to still further increase the dividend. The Managing-Director (Mr. George H. Braddock), who seconded, remarked that the state of the meter industry had not been very good in the past year—owing very largely to the depressed state of the building industry. But so far in the new financial year their orders showed an improvement over the corresponding period of the previous year. The report was adopted.

Maryport Gas Undertaking.—The Gas Manager to the Maryport Urban District Council (Mr. G. Harris) has submitted his second annual report, covering the twelve months ended the 31st of March last. He states that the make of gas per ton of coal used was 9715 cubic feet, compared with 9569 cubic feet in the previous year. The make was militated against by having to work with an insufficient number of retorts while the new bench was being erected, and afterwards by the many stopped pipes, which necessitated the lighting-up of the old beds. During the year 1221 tons of coke were sold, against 1175 tons before. This was equal to a sale of 5·25 cwt. of coke per ton of coal. There were 45,398 gallons of tar sold during the year, against 47,905 gallons. Mr. Harris explains that a slight reduction was to be looked for with higher heats, and a sale of 9·8 gallons per ton is fairly satisfactory. The net increase in the number of prepayment gas consumers was 118, against 56 before. There were 144 cookers fixed, which materially raised the summer consumption of gas.

Extension of Birkenhead Boundaries.—A communication was received by the Town Clerk of Birkenhead last Thursday, from the Local Government Board, in reply to the application of the Corporation for power to include within the borough several of the adjoining districts. The matter was the subject of a long inquiry held early in the year by Mr. H. Shelford Bidwell, M.Inst.C.E., one of the Board's Inspectors. The Corporation wished to incorporate seven adjoining areas, with a total acreage of 6782; bringing up to 9632 acres the area of the enlarged borough. At the inquiry, the suggested financial arrangements between the borough and the areas proposed to be incorporated were explained by Mr. William Cash, who estimated that the capital expenditure in the present borough during the five years succeeding amalgamation would amount to £227,455, and that the requirements of the out-districts during the same period would be £89,047; the respective annual charges on these two sums being £15,288 for the borough and £5803 for the "added areas." The Board regard favourably the greater part of the Corporation's proposals, but suggest discussion with the outside authorities on the question of differential rating. This will now play the most important part in the scheme for enlarging Birkenhead.



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BIRMINGHAM AND LONDON.

Illuminating Power of the Gas Light and Coke Company's Gas.—At the meeting of the London County Council last Tuesday, the Public Control Committee referred to the reports of the Council's gas examiners showing that there was a deficiency of illuminating power in the gas supplied by the Gas Light and Coke Company at the undermentioned testing-stations on the dates named: At Vinery Villas on June 3, 1913, at Camden Street on Aug. 8, 1913, and at Carlyle Square on April 24, 1913. In each case the Company lodged an appeal, and the cases were heard by the Chief Gas Examiner (Lord Rayleigh) on the 26th of March last. As the result, he decided that the reports concerning the Carlyle Square and Vinery Villas testing-stations must stand; the Company thereby incurring forfeitures of £2 and £50 respectively. As regards the report concerning the Camden Street testing-station, there was some question as to the accuracy of one of the instruments; and the Chief Gas Examiner decided to give the Company the benefit of the doubt. The record was accordingly cancelled. The report of the Committee was adopted.

A firm of gas-stove manufacturers has been registered at Liverpool as a limited liability company under the title of "E. A. Clark Limited," with a capital of £5000 in £1 shares.

According to the "Ironmonger," the Welsbach Light Company, Limited, of 344, Gray's Inn Road, W.C., have withdrawn the 2s. advance recently placed upon all Welsbach "Aur" mantles.

Messrs. Thomas Glover and Co., Limited, and Messrs. R. & A. Main, Limited, have appointed Mr. Glover Clark, Mr. William Batt, and Mr. J. A. Maclay as Southern, Midland, and Northern Sales Managers respectively.

Messrs. Withers and Spooner, Chartered Patent Agents, state that they have found it necessary to remove to more commodious premises. On and after the 1st prox., their address will be Staple House, 51 and 52, Chancery Lane, W.C.

The gas consumers of Brigg are allowed a special discount for large quantities used. At the last monthly meeting of the Urban District Council, it was decided to grant a further rebate of 10 per cent. on yearly accounts of £50, and 5 per cent. on £30.

Mr. Robert W. Buckingham (for many years connected with the New Inverted Incandescent Gas-Lamp Company, Limited, and previous to that a Director of Messrs. J. F. H. Taylor and Co., Limited, of Newcastle-on-Tyne) has been appointed Sales Manager to the British Graetzin Light, Limited.

The Lichfield Gas Company have placed an order with Messrs. Firth Blakeley, Sons, and Co., Limited, of Dewsbury, for a set of six of their patent rectangular vertical condensers. Similar sets erected by the firm are at work at Ely, Portland, Sedgley, and Bentham, and are said to have been found highly efficient in action.

The Harpenden District Gas Company have placed an order with Messrs. Thomas Piggott and Co., Limited, of Birmingham, for two luteless purifiers complete with R. & S. connectionless valves. The work is to the designs of Mr. F. W. Taylor, the Gas Company's Manager, under whose supervision they will be carried out.

At the meeting of the London County Council last Tuesday, the Public Control Committee reported that five firms had responded to the invitation to submit tenders for the renovation and re-verification of 22 gasholders at the Westminster gas-meter testing office; and they recommended that the lowest—that of Messrs. Parkinson and W. & B. Cowan, Limited—should be accepted for the work, other than certain optional items which it had not been definitely decided to carry out. The report was adopted.

A gas exhibition was held in the Public Hall, Tarporley, last week. It was opened by Canon W. O. Hughes, who spoke at length on the great advantages attending the use of gas for lighting and cooking. An excellent display of gas-stoves, fittings, &c., was made by the Gas Company, the Chairman of which (Mr. W. A. Schultz) said the Directors were grateful to Canon Hughes for opening the exhibition. Each afternoon and evening, Miss Surridge gave interesting cookery lectures, which were very well attended.

In the course of an address in the Aberdare Market Hall a few days ago, Mr. Steel Maitland made some reference to the British Mannesmann Tube Company, Limited, and the use of Continental tubes. The "Western Mail" last Saturday contained an explanatory paragraph, in which it was stated that the Company took over the Landore works about fifteen years ago, when they were in a dilapidated condition, and when only from 300 to 400 men were employed. Since then they had spent about £250,000 in improving the plant and extending the works; and at the present time they employed a staff of nearly 1600 men.

APPLICATIONS FOR LETTERS PATENT.

11,591.—Cohn, S., "Mantle making." May 11.
11,628.—Cowan, W. H., and Parkinson and W. & B. Cowan, Ltd., "Prepayment mechanism." May 11.
11,759.—Grundy, R. R., "Gas-lighters." May 13.
11,777.—Shewring, F., "Liming apparatus." May 13.
11,927.—Julius Pintsch Akt.-Ges., "Lighting railway coaches by gas." May 14.
11,972.—Bisseker, H., "Taps or cocks." May 15.
12,006.—Hibberd, C. E., and Goad, F. L., "Gas-meters." May 15.
12,036.—Rasch, L., "Burners." May 15.
12,040.—Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz and Frager, A. J., "Rotary piston-meters." May 15.
12,049.—Ciselet, E., and Deguide, C., "Extraction of sulphur from gas." May 15.
12,066.—Peterson, F. P., "Manufacture of gas." May 15.
12,154.—Pitner, M. W., "Burning gas for heating." May 16.
12,156-7-8.—Lederer, A., "Electric gas-lamps." May 16.

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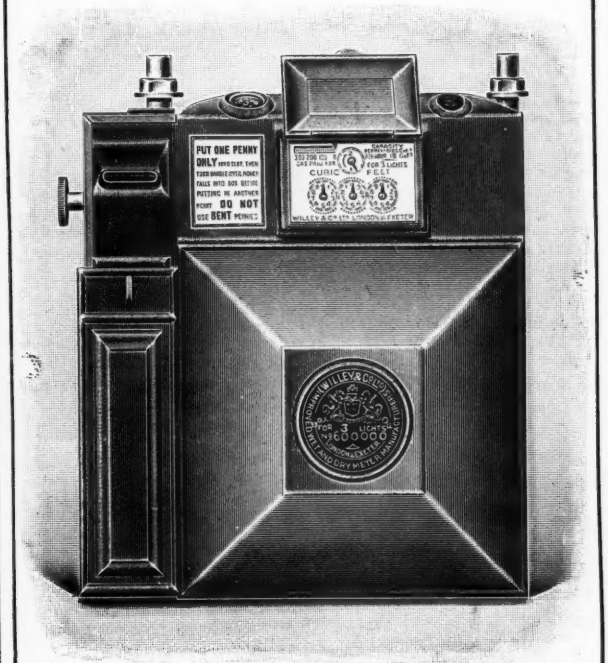

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"METERS, LEICESTER."

Telephone Nos.:
132 EXETER.
224 DALSTON, LONDON.
4777 LEICESTER.
7419 CITY (MANCHESTER).

LONDON WORKS & OFFICES:
91-95, Hertford Road, Kingsland, N.

MANCHESTER:
50, John Street, Chorlton-on-Medlock.

AGENTS FOR SCOTLAND:
D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Macclesfield Corporation.
MANAGER (Gas Meter Works). J. Milne and Sons.
WORKS SUPERINTENDENT. No. 5886.
RENTAL CLERK. Norwich Gas-Works.
MECHANIC AND PIPE FITTER. No. 5885.
ASSISTANT ENGINEER. No. 5887.
GAS FITTERS. Blaina Gas-Works.
SECRETARY AND MANAGER. Exmouth Gas Company.
TRAVELLERS. G. J. Eveson, Birmingham.

Appointments, &c., Wanted.

REPRESENTATIVE (New Zealand). No. 5878.

Plant, &c. (Second Hand), for Sale.

LAMP COLUMNS. York Gas Company.
PURIFIERS, &c. South Bank, &c., Gas Company.

Plant, &c. (Second Hand), Wanted.

PURIFIERS, &c. No. 5883.
RAILWAY TANK. No. 5884.
SCRUBBER. No. 5882.

Gas-Works Wanted.

"D. G.," c/o Scripps's Advertising Offices.

Patent Licences, &c.

CARBIDE SUPPLY PISTONS. Hasseltine, Lake, and Co., Southampton Buildings, Chancery Lane, W.C.

Sales of Stocks and Shares.

BRENTFORD GAS CO. London Mart. June 16.
CANNOCK, &c., GAS CO. By Tender. May 27.
GRAYS AND TILBURY GAS CO. London Mart. June 9.
HARROW GAS CO. London Mart. June 9.
ROCHESTER, &c., GAS CO. London Mart. June 16.
RUGBY GAS CO. Royal George Hotel, Rugby. June 5.
SOUTH ESSEX WATER CO. London Mart. June 9.

Meeting.

MALTA AND MEDITERRANEAN GAS COMPANY. 59 and 60, Gracechurch Street, E.C. June 9. Twelve o'clock.

TENDERS FOR

Coal.

BIRKENHEAD CORPORATION. Tenders by June 17.
BROADSTAIRS GAS COMPANY. Tenders by June 17.
BURTON-ON-TRENT TOWN COUNCIL. Tenders by June 6
CALNE (WILTS.) GAS COMPANY. Tenders by June 4.
EASTBOURNE GAS CO. Tenders by June 3.
ELSECAR, &c., GAS COMPANY. Tenders by June 9.
GLOUCESTER GASLIGHT COMPANY. Tenders by May 30.
MALVERN URBAN COUNCIL. Tenders by June 5.
MIDDLETON CORPORATION. Tenders by June 6.
OLDBURY GAS DEPARTMENT. Tenders by June 13.
PETERBOROUGH GAS COMPANY. Tenders by June 8.
TAUNTON GASLIGHT COMPANY. Tenders by June 1.
TIPTON GAS DEPARTMENT. Tenders by June 9.
WELLINGTON GAS COMPANY. Tenders by June 20.

Coke.

TODMORDEN GAS DEPARTMENT.

Exhauster, &c.

MARYPORT GAS DEPARTMENT. Tenders by June 5.

General Stores.

BURTON-ON-TRENT TOWN COUNCIL. Tenders by June 6.
CLACTON URBAN COUNCIL. Tenders by June 3.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 8.

Lighting Goods (Lamps, Fittings, Mantles, &c.).

CALCUTTA CORPORATION. Tenders by July 20.
CLACTON URBAN COUNCIL. Tenders by June 3.

Meters.

CLACTON URBAN COUNCIL. Tenders by June 3.

Oil for Gas Making.

TAUNTON GASLIGHT COMPANY. Tenders by June 1.

Pipes, Specials, &c., and Pipe Line.

BRADFORD CORPORATION. Tenders by June 3.
CLACTON URBAN COUNCIL. Tenders by June 3.

Sulphate of Ammonia Still and Tar Cart.

MARYPORT GAS DEPARTMENT. Tenders by June 5.

Tar and Liquor.

BURTON-ON-TRENT TOWN COUNCIL. Tenders by June 6.
DENTON GAS DEPARTMENT. Tenders by June 4.
EASTBOURNE GAS CO. Tenders by June 4.
HOYLAKE GAS AND WATER CO. Tenders by June 12.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 8.
NORTHWICH GAS COMPANY. Tenders by June 6.
READING GAS COMPANY. Tenders by June 15.

GAS COMPANIES IN THE STOCK EXCHANGE.

The Stock Exchange could find nothing last week to cheer its spirits, and depression is becoming chronic. In addition to the unsolved political difficulties at home and abroad, markets were confronted with an extension of unrest in industrial circles, a scarcity of gold, and heavy liquidation on foreign accounts. No wonder, then, that people took a gloomy view of everything, and buyers were very rare birds indeed. No market, perhaps, suffered more than Home Governments, and Consols sustained a loss of ⅜ in the week. The opening day was quiet enough, and movements were moderate but variable. Consols were ⅛ lower, and Rails were upset by threats of labour difficulties. But American were stronger; and Foreign were very fair. Tuesday was to a great extent a repetition of Monday in its main features, with rather reduced activity; but Consols did not move. Rails were still disquieted, and prices shrank. Transatlantics were fairly supported, but Foreign were less firm. Wednesday was quiet and not over bright, prices giving way in various lines. The state of the Money Market put Consols down ⅛ for the account. Renewed Continental sales depressed lines most exploited in the Bourses; but Rails had a slight recovery. Thursday, being Ascension Day, was a closed day on the Continent, which rendered things quieter here. The tone was very heavy and flat; all the familiar factors of depression being in active operation. Consols fell ¼ for money and the account, and markets all round were weak. The gloom thickened on Friday; the darkest views being entertained regarding public affairs. Dealers were disinclined to buy, and put prices down freely in advance of offers. Consols fell another ⅛, Rails were very flat on pressure to sell, and the rest were lower all round. Saturday was very quiet, and movements were irregular—largely dependent upon pressure to close accounts. Where free from this, markets held on pretty well; but Government issues were very dull, and Consols touched 74¼—closing at 74⅛ to 74⅜. In the Money Market, there was a strong demand, and some apprehension of a higher Bank rate was entertained. Business in the Gas Market was, if anything, even quieter than the week before. More than half of it was in the premier Company's issues; and many of the minor undertakings which may generally be counted on for a few transactions were not touched at all. However, the market was not upset by that. In Gas Light and Coke, the ordinary showed about an average array of dealings at unchanged figures—101½ to 102½. In the secured issues, the maximum fetched 78½, the preference from 97¼ to 98¾, and the debenture 74½. South Metropolitan was quiet at 109½ to 110½—the same as last week—and the debenture marked 75. Commercials were left untouched. Among the Suburban and Provincial group, Brighton original realized 211½, ditto ordinary 157½, British 44⅛, South Suburban 115, Wandsworth debenture 68 (a fall of 2½), and (on the local Exchange) Liverpool "B" 144. In the Continental companies, Imperial changed hands at 162 to 163¾ (a fall of 2), Union at 81, and European at 18⅛ and 18¼. Among the undertakings of the remoter world, Monte Video marked 12⅛, Oriental 120 *ex div.*, Primitiva 6 to 6¼, ditto preference 5 3/32 and 5⅛, and ditto debenture 94¼ and 94½.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE WEEK.

Bank Rate (fixed January 29), 3 per cent. Last year, 4½ per cent. Consols, 74⅛—74⅜. Previous week, 74⅞—75⅛.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	61—66	..	3 15 9
374,000	,,	Jan. 15	4	Do. 4 p.c. Deb.	73—81	..	4 12 9
280,000	5	April 29	7½	Bombay, Ltd.	5⅛—6⅜	..	5 17 8
50,000	10	Feb. 26	16	Bourne-mouth Gas & Water { 10 p.c. B 7 p.c. Pref. 6 p.c.	29—30	..	5 6 8
352,500	10	,,	7		14½—15	..	4 13 4
75,000	10	,,	6		13½—14	..	4 5 9
380,000	Stk.	Feb. 26	14	Brentford Consolidated	260—265	..	5 5 8
330,000	,,	,,	11	Do. New	204—209	..	5 5 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	..	4 10 1
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	207—212	..	5 3 9
244,200	,,	,,	8	Do. A Ord. Stk.	153—158	..	5 1 3
530,000	20	Mar. 26	12½	British	41—45	..	5 11 1
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	90—92	..	4 7 0
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	89—91	..	4 7 11
100,000	10	—	—	Cape Town & Dis., Ltd.	1⅛—2⅛	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5—7	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	73—78	..	5 15 5
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	103—110	+1½	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	103½—105½	..	5 1 1
475,000	,,	Dec. 11	3	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2
800,000	Stk.	,,	4½	Continental Union, Ltd.	80—83	..	5 8 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	117—122	..	5 14 9
492,270	Stk.	—	6	Derby Con. Stk.	123—125	..	4 16 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
1,002,180	10	Jan. 15	10	European, Ltd.	18—18½	..	5 8 1
16,386,660	Stk.	Feb. 12	4/17/4	Gas Light and Coke { 4 p.c. Ord. 3½ p.c. max. Pref. 6 p.c. Con. Pref.	101—103	..	4 14 7
2,600,000	,,	,,	3½		76—79	..	4 8 7
4,062,235	,,	,,	4		96—99	..	4 0 10
4,674,850	,,	Dec. 11	3	Coke { 3 p.c. Con. Deb.	73½—75½	..	3 19 6
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	..	5 12 4
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16¾	..	6 11 4
131,000	Stk.	Mar. 12	7⅝	Ilford A and C	151—154	..	4 19 0
65,780	,,	,,	6¾	Do. B	115—118	..	5 3 10
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
4,940,000	Stk.	May 14	9	Imperial Continental	162—167*	−2	5 7 9
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	..	4 1 5
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	..	5 7 5
561,000	Stk.	Feb. 26	10	Liverpool United A	211—213	..	4 13 11
718,100	,,	,,	7	Do. B	143—145	..	4 16 7
306,083	,,	Dec. 30	4	Do. Deb. Stk.	99—101	..	3 19 3
63,480	Stk.	Dec. 30	3	Maidstone 3 p.c. Deb.	65—67	..	4 9 7

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	Dec. 11	6	Malta & Mediterranean	4⅜—4⅞	..	6 3 1
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	98—100	..	4 10 0
541,920	20	Nov. 27	4	Monte Video, Ltd.	11⅞—12⅜	..	6 9 4
1,775,892	Stk.	Feb. 26	4½	Newc'tle&G'tesh'd Con.	9⅛—10⅛	+⅛	4 10 0
529,705	Stk.	Dec. 30	2½	Do. 3½ p.c. Deb.	83½—84½	..	4 2 10
55,940	10	Feb. 26	1/14 0	North Middlesex 7 p.c.	13½—14½	..	5 6 2
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122*	..	6 11 2
60,000	5	Mar. 26	10	Ottoman, Ltd.	7¼—7⅜	..	6 9 0
60,000	50	Feb. 26	18	Portsea, Island B	128—131	..	4 19 3
100,000	50	,,	12	Do. C	118—121	..	4 19 2
249,980	5	April 29	8	Primitiva Ord.	6—6½	..	6 3 1
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	5—5¼	..	4 15 3
521,600	100	Dec. 1	4	,, 4 p.c. Deb.	93—95	..	4 4 3
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	87—89	..	4 9 11
150,000	10	May 14	6	San Paulo { 6 p.c. Pref. 5 p.c. Deb.	10⅜—11¼	+⅛	5 6 8
125,000	50	Jan. 2	5		48—50	..	5 0 0
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	..	4 9 3
209,984	,,	,,	10	Do. B	222—224	..	4 9 3
523,500	,,	,,	10	Do. C	222—224	..	4 9 3
90,000	10	Oct. 15	7½	South African	11—12	..	6 5 0
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	109—111	..	4 18 6
1,895,445	,,	Jan. 15	3	Do. 3 p.c. Deb.	73—75	..	4 0 0
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	..	5 6 11
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	..	5 3 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	..	4 9 3
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	113—115	..	4 6 11
629,740	Stk.	May 14	5	Southampton Ord.	99—102*	..	4 18 0
120,000	Stk.	Feb. 12	7⅜	Tottenham District { A 5 p.c. B 3½ p.c. 4 p.c. Deb.	185—188	..	5 6 10
543,940	,,	,,	5⅞		115—117	..	5 0 5
149,470	,,	Dec. 30	4		89—91	..	4 7 11
182,380	10	,,	5	Tuscan, Ltd.	5—6	..	8 6 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	95—97	..	5 3 1
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	−½	4 11 4
30,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—155	..	5 7 4
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	..	5 2 7
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	..	5 2 0
352,000	,,	,,	6⅛	Wimbledon 5 p.c.	117—122	..	5 0 5
98,000	,,	,,	6⅜	Epsom 5 p.c.	121—126	..	5 5 2
88,416	,,	Dec. 30	3	3 p.c. Deb. Stk.	68—71	−2½	4 4 6

Prices marked * are "Ex Div."